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Engineering News-Record

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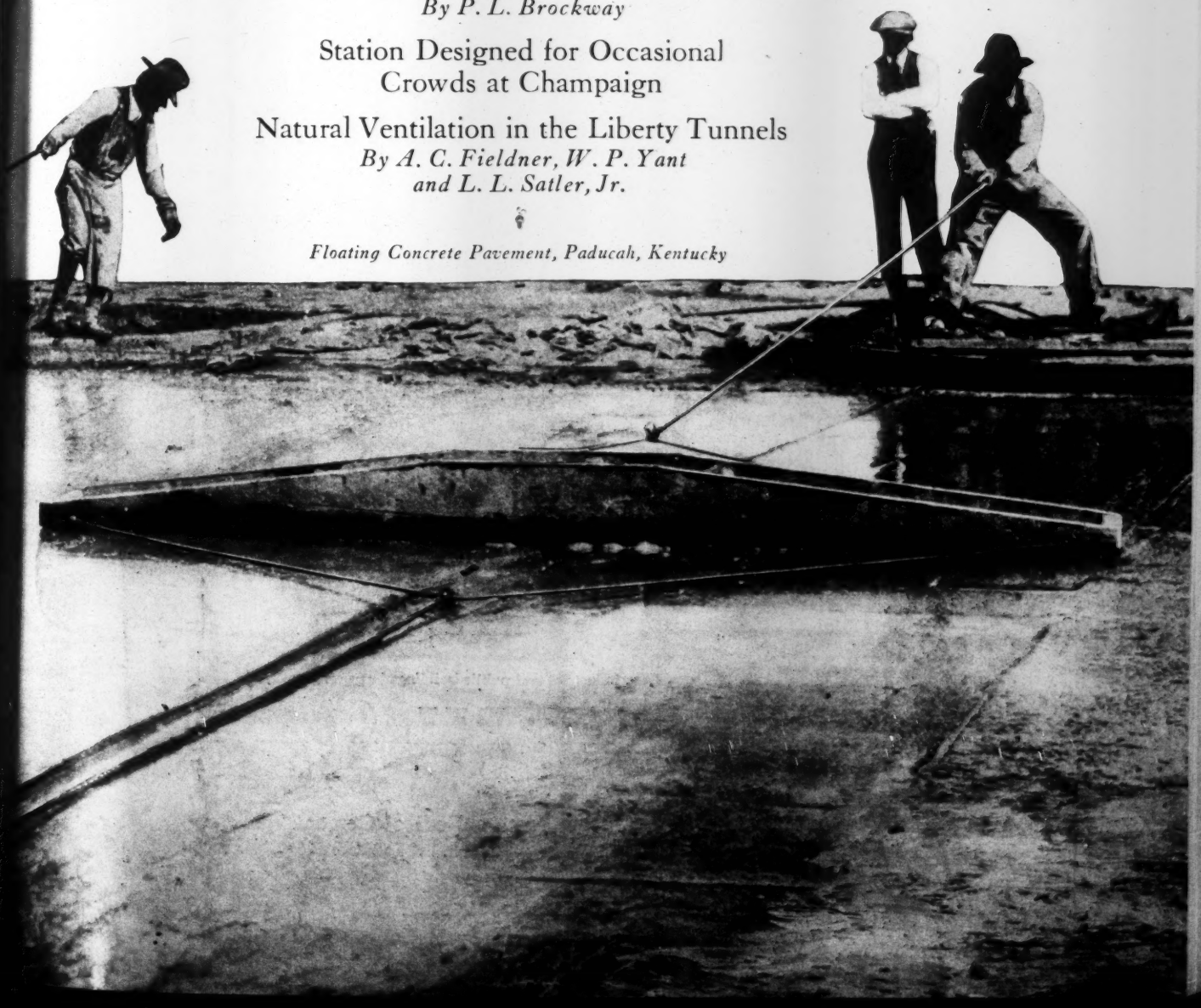
Street Pavement Design Based on Bates Road Tests
By J. C. Keeley

Cableways Handle Excavation and Fill on Wisconsin Dam

Measured Changes in Shape of Multi-Arch Bridge
By P. L. Brockway

Station Designed for Occasional Crowds at Champaign

Natural Ventilation in the Liberty Tunnels
By A. C. Fieldner, W. P. Yant and L. L. Satler, Jr.



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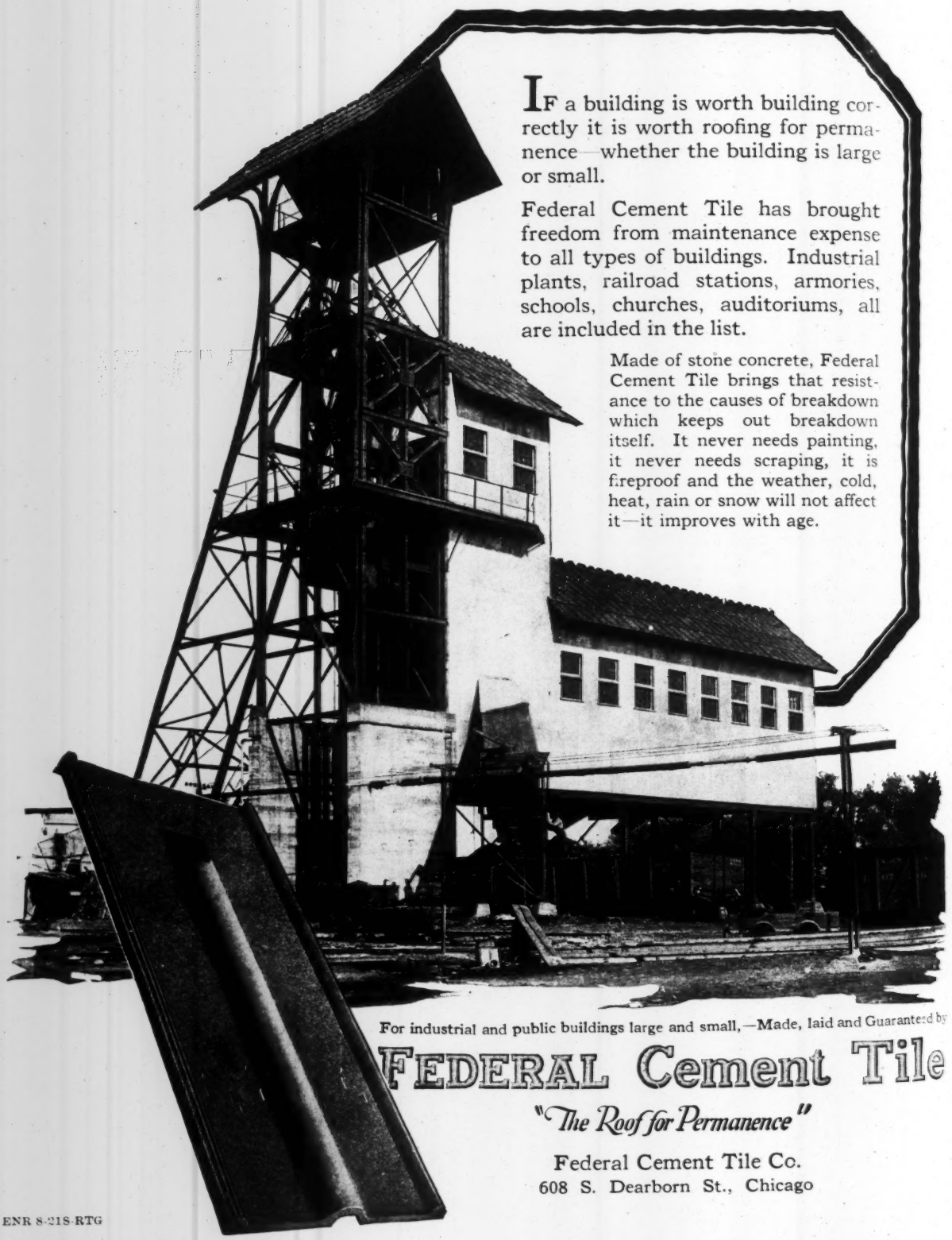

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

Volume 93 NEW YORK, AUGUST 21, 1924 Number 8

Reparations Accord

AGREEMENT on German reparations in accord with the Dawes' plan, reached abroad last Saturday, is full of promise for world peace and prosperity. Ratification by the legislative bodies of France and Germany must be had but outside of extremists in those countries, believed to be in the minority, and pessimists elsewhere, assuredly a small minority, ratification within a few weeks is believed to be assured. What a blessing to the whole world ratification and fulfillment by all concerned will be needs no attempt at exposition.

Co-ordinating Highway Research

OFFICIAL representation by state highway departments on the Advisory Board on Highway Research of the National Research Council should strengthen the influence of a technical body which has already put itself into a useful position in the highway industry. The new plan of organization is made clear by the chart published elsewhere in this issue. It is interesting to note, too, that the carrying out of the plan has proceeded so far that 38 of the 48 state road departments have named their representatives. So far the work of the advisory board has been carried on largely by a comparatively few enthusiastic research workers in the fields of highway engineering and highway transport. These few have done remarkable work; both quality and value have been exceptional for a purely voluntary service. The handicap has always existed, however, that the advisory board has never represented in any complete manner highway thought as officially represented by state highway departments nor has it secured the close interest of those bodies in its work. Indeed the advisory board seems always to have performed a detached function in the road industry. Without question its director and its advisors have not willed this; in fact it is certain that they have made earnest effort to avoid the position of being apart from the daily concerns and activities of the highway officials who are directing the actual work of improvement. Representation by state highway departments on the board is a positive move toward real co-ordination of interest. It deserves hearty commendation.

New Jersey-New York Transit

LITTLE has yet been done to provide the North Jersey Metropolitan District with quick and easy transit to New York. Less has been done to give the cities and towns in that section anything but slow and roundabout means of intercommunication. Acting on the principle that help will be given to those who make a start towards helping themselves, citizens and civil organizations of the trans-Hudson communities bestirred themselves two or three years ago. A voluntary organization was formed to work for improved transit. Legislative recognition was secured and an investigation commission was created but in the slow and uncertain progress of most things of the sort, there was a slip-up on providing funds last year. However, the commission and other agencies stirred up a deeper public interest and an appropriation of $25,000 for the work of the commission has enabled it to start more active work by the appointment of an engineer, consulting engineer, and executive secretary, as noted in our news section last week. The sum now available is small for even a beginning of a study of so large a problem as providing ways and means to enable thousands of New Jersey citizens to get to and from New York without the sacrifice of time and convenience that the twice-a-day trip now imposes. Better intercommunication between the New Jersey suburbs is a secondary consideration but one of importance. Presumably several years will be consumed before anything concrete will be accomplished, for if large bodies move slowly it takes even more time to get many bodies, large and small, to move consistently and persistently in one direction.

Growth by Water

IF WATER ever made a city where without it a city never could have been, Los Angeles is an example. First it utilized the Los Angeles River and its underflow. Then it adventured boldly far across the Mohave desert to the Sierra-fed headwaters of Owens River, 250 miles away, far outdistancing any other city in going afield for water. Meanwhile it made another adventure to get the advantages of water for a quite different purpose but one which it considered essential to establishing itself among the cities of the world; that is, by its shoestring and seaside territory annexation it made itself a seaport, and no mean one at that, as time has shown. And now, only ten years after the steel conduits from the end of the Los Angeles aqueduct proper began delivering water, Los Angeles has well under way field surveys for water from the Colorado River. Curiously, the distance from the proposed Colorado intake to reservoirs in the foothills near Los Angeles, as reported on p. 277 of our issue of Aug. 14, is the same as the length of the Los Angeles aqueduct proper, 225 miles. Otherwise the contrast in the two sources of water supply is great. The Owens River intake is 3,812 ft. above the sea, providing not alone a gravity supply but much hydro-electric power. Colorado River water would be lifted 1,400 ft. by a succession of pumping plants to an elevation of 1,700 ft., before the gravity aqueduct would begin. The cost of the Los Angeles aqueduct to the close of 1913 was about $25,000,000. The rough cost estimates of the Colorado project thus far possible run from four to eight times that amount. Neither figure will stagger a city which has literally grown by water in the last quarter century—so fast that the Census Bureau, in its 1924 population estimates for the larger cities of the country puts this one and a few others in a class by themselves for which no estimates are attempted.

Ten Years of Panama Canal Operation

RECENT heavy growth of traffic through the Panama Canal is said to have put it on a commercially paying basis as it completes ten full years of operation. So at least runs the dispatch from Colon, sent by Colonel Meriwether Walker, acting governor of the Canal Zone, on Aug. 14, after the record for the day and year had been closed. The dispatch states: "Deducting from the gross receipts the cost of operation, including civil government and incidental expenses and allowing for the depreciation of shops, buildings, equipment, etc., and deducting for interest on the investment, the present volume of business produces enough revenue to allow a handsome surplus to be turned into the treasury annually."

This is encouraging, but it would be interesting to know how fully the depreciation and interest allowances accord with sound commercial accounting. Details could not be expected in a press dispatch sent on such an occasion but an examination of the latest annual report (1922-23) of the Governor of the Panama Canal leads to the conclusion that commercial accounting is not applied to Panama Canal operations, although perhaps more so than federal enterprises.

It would surprise most people to know what the real cost of the Panama enterprise was when it went into use and what the annual deficits have totalled since then. We write this not in disparagement, for the canal is an enterprise that does great credit to all concerned, and the recent heavy traffic and revenue with apparent profits for the year just past are a credit to all concerned. But it seems desirable to call attention to the misleading character of allegations of profits frequently made by government enterprises, whether federal, state or municipal. Rarely are accounts so kept that anyone knows what the real profit or loss on these enterprises is, or even so they could be reckoned without much difficulty.

It is true that many of these enterprises yield collateral benefits difficult or impossible of estimate—witness in the case in point the military and commercial value of the Panama Canal to the United States. But that is no excuse for a lack of proper accounting, or in the absence of it for not refraining from making claims of profits that will not stand careful analysis.

It may be noted before concluding that the rapid increase in Panama Canal traffic and tolls of late has raised a question in some people's minds, particularly in the minds of the advocates of a sea-level canal at Panama whether the traffic will not soon outgrow the capacity of the canal. Colonel Bunau-Varilla predicts that it will do so in ten years and, consequently, would have the government spend all the income from tolls in deepening and enlarging the canal until it reaches sea level. In this way, he claims, the canal could be enlarged without costing the people of the country one cent more. But these advocates of an enlarged canal do not appreciate that the apparent growth in traffic is made up largely of an abnormal increase in the oil traffic from Californian oil fields, a traffic which has already passed its peak and cannot be considered as permanent. Excluding this traffic the normal increase is such that the canal can carry all the traffic for many years to come. Colonel Walker estimates that it can carry three times as much as is now handled. Therefore, there seems to be no reason why more money should be spent in enlarging the canal. In this time of high taxes the profits can be used elsewhere better.

Exactly what these profits amount to would be much easier to determine if the canal were put on the same basis as any ordinary business enterprise with a certain amount of capital charged to its account, upon which the canal administration would pay interest, and with the expenses of operation paid out of tolls and the cost of improvements charged to the capital account. Under these conditions we would no longer have to have annual appropriations for the canal, a large amount of government bookkeeping would be eliminated and the governor could give account of his stewardship in an annual report which would show clearly just how profitable the undertaking has been.

Changes in Water Treatment

IT WOULD be interesting to know how many slow sand filtration plants in the United States have given place to rapid or mechanical filters or at least have been reinforced by pre-filtration with or without coagulation or by coagulation alone. The conversion of a small slow sand to a mechanical filter plant at Putnam, Conn., was briefly described in our issue of Aug. 14. The change took place after the slow sand filters had been in service 17 years, but would have come sooner had it not been for the war and post-war economies. The utilization of the structural portions of the slow sand filter to contain the mechanical filters and all accessories and still provide a plant of several times the capacity of the original filters illustrates the economy of space of mechanical as compared with slow sand filters.

The oldest slow sand filter of the English type to be built in this country, the one put in operation in Poughkeepsie, N. Y., in 1870, was reinforced with pre-filters years ago, and the same general thing has been done at Albany, N. Y., in the case of one of the very earliest of the modern type of American slow sand filter. When Philadelphia built the largest aggregation of slow sand filters in the world it installed pre-filters in some cases at the start. Others have been added since. Programs of the day at both Philadelphia and Albany will provide each city with rapid filters to lessen the burden on the old slow sand filters. At Washington, D. C., precoagulation was introduced as soon after the slow sand filters were built as local projudice against treating the water with alum could be overcome. By now, had appropriations been forthcoming, the slow sand filters at Washington would have been supplemented by mechanical filters, independent of the original plant. Some years back, when the slow sand filters at Toronto, Ont., could not supply the increased demand for water, "drifting sand" filters were built alongside but independent of the old filters. These were a modified type of mechanical filter. Now that still more filter capacity is needed at Toronto it will be interesting to see whether the third plant will be of the slow sand, the "drifting sand" or the standard mechanical type.

Economy of space and of labor, greater general convenience, and color removal have all been factors in the changes from slow to rapid filters, rather than the attainment of a higher degree of hygienic quality of the water than slow sand filters readily give. Even today, when mechanical filters have become almost a matter of course, there are few if any engineers who would claim that they are on the whole more effective

and reliable than slow sand filters. Finally, chlorination as a factor of safety and an element of economy has helped largely in establishing mechanical filtration. Not only here but with slow sand filters and where filtration has not been adopted, it is accepted as a form of health and life insurance which can be had at a low rate. Where filtration is lacking adoption of chlorination often leads the way to filtration as the ultimate goal in the march towards safe water supplies which is progressing so rapidly today.

Jurisdictional Strike Conditions Improve

JURISDICTIONAL quarrels between labor unions are becoming less and less a provocation of strikes which unjustly tax the builder. As the "innocent bystander" he was for years compelled to submit to the closing down of his construction operations while two or more unions of employees disputing over the division of work resorted to strikes as a weapon to swing victory each to its side. This situation is becoming greatly altered and the means which has brought about the change is the National Board of Jurisdictional Awards. In five years, it is not too much to say that this committee of workmen and employers has virtually revolutionized conditions in respect to strikes arising from quarrels among workmen themselves. Both engineers and contractors know less than they ought of the work of the Board and are giving it less support than they should.

Briefly, the committee was organized late in 1919. Unionized labor has the credit of initiating this action. Previously the only means of determining jurisdictional rights, except in individual instances by battle, was hearings by the American Federation of Labor on disputes brought to its attention at its annual meetings. In these hearings the employer and owner had no voice. This exclusion from consideration of other elements of the industry than labor being recognized as unfair, and the long intervals between hearings preventing the prompt determinations which the industry required, a call to various agencies representing construction was sent out by the American Federation of Labor. The meetings which followed resulted in the organization of a permanent court called the National Board of Jurisdictional Awards.

This board was planned to consist of eight members, three to be selected by the Building Trades Department of the American Federation of Labor, and one each by the American Institute of Architects, Engineering Council, the Associated General Contractors of America, the National Association of Building Trades Employers and the National Association of Builders' Exchanges. The last-named organization did not select a representative and the Associated General Contractors of America was therefore given the privilege of naming two delegates.

According to the constitution of the board, it is invested with power to investigate all disputes of a jurisdictional nature and make awards in accordance with its findings. Should the board fail to make an award an umpire may be agreed upon whose findings shall be final. If the board fails to agree on an umpire the constitution provides that the Secretary of the United States Department of Labor shall be called upon to name an umpire. The constitution further provides that all complaints must be submitted to the board through the officials of an organization which is a party to the agreement. All of the organizations signatory to the board are pledged to suspend members who refuse to abide by its decisions.

This detail of the organization and character of the board has been given to emphasize the constructive justification with which it calls for the support of engineers and contractors. The work it has done is an even more complete justification of its demand. In its barely five years of service it has decided fifty cases of jurisdictional dispute and in all but one case the decision has been accepted and the dispute settled. This is a record of rare efficiency. It signifies a money saving made for the construction industry that is beyond estimate.

Shall the Board of Jurisdictional Awards be helped to greater activity and better work? The answer is squarely up to engineers and contractors. At present the board is handicapped by the apathy of both. Lacking in a large degree their actual aid the board is unable to bring to bear the forces that it might to consolidate the building trades, some of which now refuse to be signatories to the plan, solidly behind the principle of settlement of jurisdictional labor disputes without strikes.

A Significant Bond Issue Defeat

DEFEAT of a $7,000,000 bond issue at Cincinnati on Aug. 12, for every one of 45 separate public improvements, well distributed throughout the city, is of more than local interest.

Various county circumstances indicate that the people of Cincinnati do not trust their city government. That all 45 improvements should have been defeated is all the more significant because 18 of them had been endorsed by the local engineers' club, after investigation, and by the directors of both the automobile club and the Chamber of Commerce, and because a representative of the Technical Advisory Corporation had asserted that the proposed improvements fitted into its recommendations for a city plan. The improvements had the endorsement, also of the Federated Civic Association of Hamilton County and the dominant political organization of the city and county. The endorsement of the latter perhaps contributed to the defeat of the bonds, for but recently municipal research investigators from outside the city, engaged—such is sometimes the irony of fate—by a committee of this organization, had made a lengthy report strongly condemnatory of the city government and alleging that instead of being the servant of all the people it was subservient to a single man—unnamed but well known locally. It appears that with one exception all other recent proposed bond issues in Cincinnati have been voted down. The local realtors' association and at least two civic organizations advised the same fate for these just defeated.

In view of all these facts, and the well-known American trust in changing the form of government instead of placing reliance on the voters to keep true representatives in office, it would not be surprising, especially in view of a recent movement for charter amendments, if Cincinnati soon followed the lead of its big sister, Cleveland, and adopted the commission-manager plan of government, with proportional representation as the method of electing the members of the commission.

Natural Ventilation in the Liberty Tunnels

Systematic Observations of Six Months' Use of One-Mile Vehicle Tunnels Without Forced Ventilation Show Normal Condition Satisfactory — Dangerous Carbon-Monoxide Concentration During Traffic Jam

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BY A. C. FIELDNER
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IN VIEW of the recent incident in one of the Liberty vehicular tunnels at Pittsburgh, when there was an accumulation of automobile exhaust gas and several persons were overcome, the ventilating conditions in those tunnels engage attention. The U. S. Bureau of Mines, in co-operation with A. D. Neeld, engineer in charge of construction of the tunnels, and the Commissioners of Allegheny County, has made daily analyses of the air and kept a record of the natural ventilation, together with a traffic count, ever since the tunnels were opened to limited traffic, pending installation of the ventilating fans. Until within the last few weeks, when these fans were placed in operation, the only ventilation was that due to differences in air pressure at the two

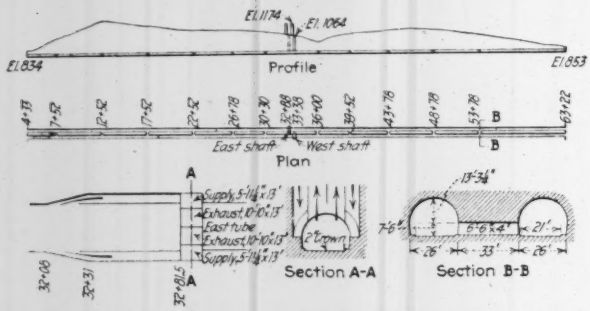


FIG. 1—SKETCH PLAN OF LIBERTY TUNNELS INDICATING VENTILATION FEATURES

ends of the tunnels and to the air movement set up by motion of motor cars and trucks.

Air Movement in Tunnels—Since the tunnels are twin parallel tubes only 59 ft. apart and have a slight grade, the effect of natural differences of pressure will, with the exception of the effect of the wind baffle at each exit, be practically the same for each tunnel. Numerous readings taken with no traffic have shown that this effect sets up air velocities from zero to 400 ft. per minute on the average, with exceptional cases of 700 to 800 ft., always in the same direction in the two tubes at a given time, but often reversed in direction in the course of a few hours, especially with the lower velocities.

However, the outside air pressures are not the controlling factors in the air direction and movement during the passage of traffic. Since the traffic is in opposite directions in the two tubes (there are two lines in each), under any condition of natural air movement the traffic will tend to oppose the natural draft in one or the other of the tubes. The traffic effect is much greater than the natural effect. As few as 100 to 200 automobiles per hour, running at a speed of 30 to 40 miles, will entirely reverse the direction of a natural air movement of 200 to 300 ft. per minute, setting up a similar motion in the opposite direction, which is, under ordinary conditions, sufficient to ventilate the tunnels adequately for several times that number of cars. On certain occasions the traffic has been at the rate of 900 cars per hour through each tube, the resultant air motion being 600 to 800 ft. per minute in the tube where the traffic was opposing a natural velocity of approximately 200 ft. and 800 to 1,000 in the other tube.

Carbon Monoxide Production—Taking an average figure of 2 cu.ft. per minute for the carbon monoxide (CO) liberated by an automobile running 30 miles per hour, the amount liberated by 1,000 machines passing through the one-mile tunnel in an hour would be 4,000 cu.ft. As the cross-section of each tunnel is 468 sq.ft., an air velocity of 600 ft. per minute, or 36,000 ft. per hour, would produce 16,848,000 cu.ft. of ventilation, which would dilute the exhaust gas to an average composition of 2.5 parts of CO per 10,000 parts of air, whereas 4 parts per 10,000 has been set as an allowable concentration for an exposure of 1 hour.

Traffic has exceeded 300 to 500 cars per hour through a single tube rarely except on Sundays and holidays. The air movement ranges from 300 to 500 ft. per minute. Analyses of the tunnel atmosphere at ½-hour intervals from 7 a.m. to 11.30 p.m. during the first two months the tunnel was open usually showed less than 1 part of CO per 10,000 parts of air. However, on occasions when a strong wind against the traffic in one of the tubes just balanced the effect of the moving cars there was a localized accumulation of gas 500 to 2,000 ft. in length, which would change its position in the tunnel according to the alternation in direction of prevailing air motion. At times the concentration of CO would build up to 6 to 10 parts, and in one instance to 16 parts per 10,000. These were the only periods, excepting the traffic jam of May 10, 1924, that necessitated stopping the traffic and allowing the natural air velocity to blow out the gas, which usually required about 15 minutes. Traffic has been stopped daily between 11 and 11:30 a.m., and 10 and 10:30 p.m. to take air velocity readings with no traffic. These periods have a few times also relieved slight gas accumulations which otherwise might have necessitated closing the tunnels later. With the exception of these cases, the amount of gas in the tunnels has been less than 2 parts, and most of the time less than 1 part per 10,000, or a negligible amount from the standpoint of health and safety for the time of exposure.

Traffic Congestion on May 10—The tunnels have opened a comparatively undeveloped portion of the city of Pittsburgh, and the traffic volume, which is now very low in comparison to the capacity of the tunnels, will, no doubt, rapidly increase to a point where, due to congestion, it will be impossible to keep the traffic moving rapidly and without stops. Breakdowns of machines in the tunnel which will temporarily stop traffic are certain to occur, as well as causes for holding traffic at the exits. This will greatly reduce and at times entirely remove the ventilation set up by car

motion, and in addition obstruct the natural ventilation. Under these conditions the machines will continue to give off CO, and a dangerous concentration thereof will occur. This is exactly what occurred on May 10.

On account of a street-car strike, the volume of automobile traffic all over the city was enormously increased by people using every automobile available to go to work, causing traffic and congestion jams at intersections of main thoroughfares, especially at the main inlets and outlets to the downtown section of the city. The volume of traffic through the inbound tunnel was increased from the average of 300 per hour to a peak of 1,200 per hour which, however, was not much greater than the number that had gone through on certain other occasions. The air velocity was 600 to 700 ft. per minute, which is about twice that needed for the above number of cars to keep the concentration of gas below the limit of 4 in 10,000 recommended as allowable for an exposure of 1 hour. Had the traffic been able to proceed without interruption no difficulty would have arisen.

The present inlet to the city of the south Liberty tunnel is into an avenue at a point where the latter has considerable grade. This makes a rather difficult exit for tunnel traffic going to town, as it must cross over the outbound traffic coming up the hill, and swing into the stream going down. All of this traffic, together with that from another street which connects at the bottom of the hill, must cross the Monongahela River into the city by way of a narrow bridge permitting but one line of traffic each way. Even under normal conditions of traffic there is at times more or less congestion at this point.

On May 10, with every street intersection congested, it was impossible to get the volume of traffic over the bridge into the city, and the vehicles blocked the street from curb to curb in places, up the hill past the tunnel outlet. Movement was slow and intermittent. This condition, together with the difficult outlet of the tunnel traffic into this street, virtually closed the tunnel, leaving it full of automobiles unable to move out. With the cessation of car motion the main means of creating ventilation was lost.

The last air reading, taken a few minutes before traffic stopped, was over 500 ft. per minute, but it is safe to assume from previous observations that the velocity dropped rapidly when the cars in the tunnel stalled; no readings were taken during this period, as the observers turned to assist in taking care of the congestion and the resultant panic. Further, natural-draft ventilation was no doubt reduced by the obstructing effect of the cars, and an accumulation of gas resulted. It is difficult to state just what the concentrations of CO were at various places, because some drivers raced their motors in the excitement, thus causing localized accumulations, while others shut theirs down. Also, there was a good deal of stagnant exhaust gas between the closely packed cars, and it is very likely that certain individuals were at times exposed to this. A sample taken for analysis showed 25 parts of CO per 10,000, but it is reasonable to believe that the concentration was higher in certain places and lower in others.

Effect of Gas—The cases of gassing that resulted were mainly of a mild nature. The majority of analysis of blood samples showed but 20 to 25 per cent of their hemoglobin in combination with CO, which caused no other symptoms than headaches. Several persons had reached the stage of nausea, and four or five, mainly traffic officers and men who had been exposed for approximately an hour in assisting in clearing the tunnel, had absorbed an amount of the gas sufficient to cause collapse. Analysis of blood samples taken from these men showed it to be 35 to 45 per cent saturated with CO. Except for the men vigorously engaged in trying to restore order and get the drivers to shut off their engines, the majority of the pronounced cases of mild asphyxia occurred among those who exerted themselves trying to get out. A large number crossed through passageways which connect the two tubes at 500-ft. intervals, and came out through the other tunnel, the air of which was in a safely ventilated condition. With the removal of the congestion, the gas cleared out of the tunnel and normal traffic was resumed.

Handling Stalled Traffic—The psychology of a crowd under conditions such as these is important in relation to prevention or control of such occurrences. When

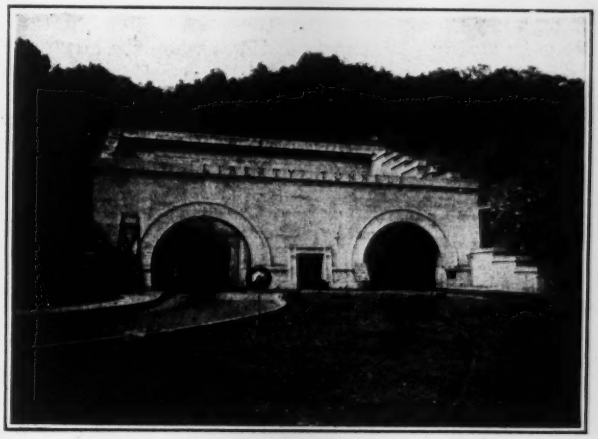


FIG. 2—PORTAL OF LIBERTY TUNNEL

congestion was imminent at these tunnels, men in the tubes engaged in taking ventilation data, and others working about the tunnel, went through requesting drivers to shut down their engines, but many of these, not realizing the danger, stupidly raced their engines and blew their horns much the same as at a closed railroad crossing or similar places where indefinite hold-ups of traffic occur. This increased the confusion and made order impossible, as well as greatly excited people of nervous temperament. When the smoke began to accumulate, and the people began to realize the danger of the situation, many of them deserted their cars, some leaving the engines running, and naturally an uncontrollable panic among the more excitable type was soon created. Had all drivers complied with the request to stop their engines, the resulting condition would have been in a large measure averted.

It is shown by this experience that it is impossible to control a crowd under these conditions, and it is very necessary to make provisions against their occurrence rather than make plans for taking care of them once they have occurred; and likewise that the mechanical ventilating system for such tunnels must be adequate to take care of the maximum traffic jams possible, since human control of traffic will break down in times of emergency.

Force Account and Winter Work on Small City Jobs

Very Satisfactory Experience Under Local and Special Conditions Does Not Indicate Day Labor Invariably Wise

By Ivan E. Houk
U. S. Reclamation Service, Denver, Colo.

As city engineer of Dayton for a portion of the period considered in his article the author had full means of knowing the results of force account construction. His conclusions are worth careful attention as being eminently logical and sane.—Editor.

EXPERIENCE in building public works by force account at Dayton, Ohio, has shown that the method is often, but not always, advisable. In general, day labor has been found economical in times of unemployment, when first-class foremen and efficient labor are plentiful at reasonable prices; in cases of comparatively small jobs of ordinary nature where the costs of organization and preliminary preparations are relatively large proportions of the total cost; at times when the city has idle equipment suited to the work in question; and in instances where the contractors have combined with the intention of controlling construction costs. Of the million and a half dollars worth of work done in 1922 and 1923, approximately 25 per cent was carried on by force account methods.

Economy Shown—A good part of these improvements was begun in the fall of 1921 and carried on during the following winter months when the unemployment situation was worst, primarily with the view of providing work for the needy, believing it better policy to provide work than charity. It developed, however, in the case of the culverts especially, that considerable money could be saved the taxpayers by doing the work at that time. For instance, construction companies, because of the lack of work, were glad to loan the city their best foremen at their regular straight time rates. They were also glad to rent their equipment at reasonable prices. Sufficient and efficient first-class common labor was obtained at fair prices. The men knew they were lucky to be given jobs, and showed their appreciation by giving a day's work for a day's pay. Consequently the city was able to build the culverts at approximately two-thirds of the estimated costs.

While the sewers were built at costs within the estimates in practically all cases, the savings in the work done during the unemployment crisis were not so great as in the case of the culverts, or as in the case of the earlier or more recent sewer work. There were two causes primarily responsible for this, both of which hinged on the labor situation. One was that in order to furnish some work to as many men as possible, new gangs were put on each week, keeping only a few of the best men on each job to serve as a nucleus for the new gang. Thus the foremen were handicapped by continually breaking in new men. About the time the men became accustomed to the job so that they could work efficiently, they were laid off and new men put on in their places. The other cause was that practically all of the work was done by hand instead of by machinery, even the mixing of the concrete in some instances. In the more recent sewer work, as well as in that carried on before the business depression, when labor was scarce instead of plentiful, power diggers, trenching machines, concrete mixers and other types of machinery were used whenever possible. Consequently the costs were kept proportionately smaller and the savings over the estimates made correspondingly larger.

Incidentally to the force account construction the possibilities of winter sewer building were determined. It was found that in Dayton sewer construction can be carried on practically throughout the winter months. It seldom is necessary to stop the work more than a week or so on account of cold weather, especially in the case of monolithic concrete sewers; except, of course, during such severe winters as that of 1917 to 1918 when the long continued period of below-zero weather outlasted any similar period shown by the forty years of Weather Bureau observations. In the winter of 1921 and 1922, work on the monolithic concrete sewers was scarcely interrupted although the temperatures hovered near zero at times. The ground ahead of the trench was kept thawed out by keeping it covered with well rotted manure; while the fresh concrete was kept from freezing by similar coverings and by lanterns placed inside the sewers, the ends of the sewers being blocked at night so as to keep the heat inside. Since the sewers were from 12 to 20 ft. deep the bottoms of the excavations were considerably warmer than the surface of the ground. In no instance was it found necessary to heat the aggregate. However, in the case of the pipe sewers no pipes were laid when the temperatures were much below freezing, since the cold pipe chilled the small amount of mortar necessary to fill the joints before it had time to set.

In the case of the reinforced-concrete culverts and a foundation for a sewage pumping station the water was heated and the concrete was kept from freezing by coverings of straw and manure and by salamanders kept burning around the edges of the work. In the case of the pumping station the sand and gravel stock piles were kept thawed out, and heated to a certain extent by live steam delivered through a network of pipes that had been laid on the ground before the materials were dumped, the steam being supplied by a traction engine and being turned on two or three days before the pouring. While these precautions involved some extra cost, it is believed that the additional expenditures were more than balanced by the favorable labor conditions existing at that time.

Winter Working Conditions—It is doubtful if sewer construction in Dayton is more expensive in winter than in summer. A study of the costs records of sewers constructed during different times of the year does not indicate any decrease in unit costs during the summer months. The men in the trench are sheltered from the wind, and to a certain extent from the cold, and consequently are really laboring under more comfortable conditions in the winter than during the heat of midsummer. In the case of hand excavation at least, the men are probably more efficient in the winter than in the summer.

Thus far Dayton has not found it necessary or advisable to do much new street improvement work by force account; except, of course, the comparatively small jobs, which, like the sewer installations, are really of a maintenance nature, and can be handled by the maintenance crews. Satisfactory competitive bidding, result-

ing in fair contract prices, has usually been obtained in the case of new street work, as outlined in *Engineering News-Record*, Sept. 14, 1922, p. 459. Force account methods have been used in a few instances where the legislation, started during the period of rising prices, did not provide sufficient funds. In such cases it was considered better policy to do the work by force account rather than by contract. Force account methods were also used in a few instances after the war, on jobs for which no bids could be obtained.

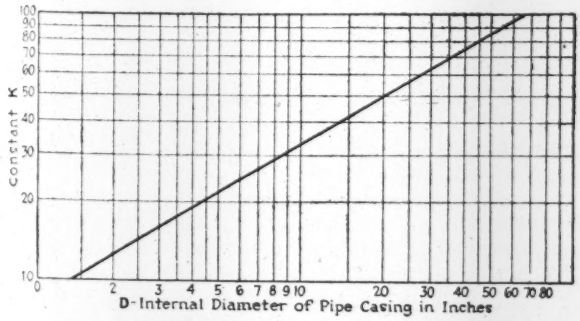
The conclusion from all experience at Dayton is that each job of appreciable magnitude should be studied individually, and all the various affecting conditions given proper consideration before deciding which method to use. Probably more public work should be constructed by force account in the future than has been in the past. However, the increase in such activities should be made when and where careful business judgment shows such procedure to be justified—not merely based on a general recommendation that such methods be used in public works construction. So far as municipalities are concerned at the present time it is only the comparatively small jobs of ordinary nature, such as the small sewer and paving jobs, jobs which are really maintenance matters and which can be handled by the maintenance crews with their routine work, that force account methods can be considered invariably advisable.

The success of the force account methods in Dayton during recent years has been primarily due to the efficient supervision of George F. Baker, director of public service, and Fred O. Eichelberger, city manager.

The California Pipe Method of Water Measurement

By Blake R. Vanleer
Assistant Professor of Mechanical Engineering, University of California, Berkeley, Calif.

Under the above heading a very simple and convenient field method of measuring the flow from water pipes was described in *Engineering News-Record*, Aug. 3, 1922, p. 190. Shortly after that article was published many inquiries came in as to whether the formula would apply to pipe casings as well as to standard pipe and if so what values should be assigned to K. Laboratory experiments were then made with pipe casing; the formula $Q = K(D - a)^{1.88}$ and the same requirements as in the case of standard pipe were found to hold and the values of K that apply were found to be as given in the accompanying curve. In laboratory tests this formula has been found to have an efficiency of 97 per cent and with ordinary care field measurements should be equally accurate.



CURVE SHOWING VALUES OF K IN FORMULA $Q = K(D - a)^{1.88}$

In measuring flow through casings the length of the discharge nipple must be at least 6 pipe diameters; it must be level and air must have access to the upper part of the nipple. If it is not convenient to use the arrangement shown in the article referred to above, which has a T to admit air, a hole drilled into the nipple at least six diameters from the discharge end can be used instead.

Having measured a and taken the value K from the accompanying table, the quantity of water flowing may be obtained by direct substitution in the formula, or by reading the quantity direct from the accompanying curve. In using the formula Q = Quantity in g.p.m.; D = Internal diameter of pipe or casing in inches; a = Vertical distance from inside of pipe to water surface in inches. K is a constant depending upon the diameter of the pipe. Where it is not convenient to make in the field the logarithmic calculation necessary to solve the formula, either a table or a diagram can be made up in advance for values $(D - a)^{1.88}$ so that computation is unnecessary. Obviously the formula does not apply when the casing is flowing full.

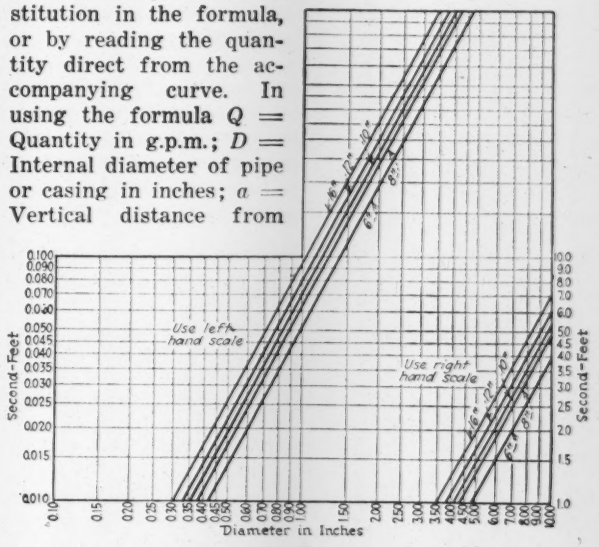


DIAGRAM FOR READING FLOW DIRECTLY WHEN $D - a$ IS KNOWN

Reconstruction in the Somme

Notwithstanding the cessation of building activities toward the end of the year, French reconstruction work in the Department of the Somme for 1923 greatly exceeded that for 1922, according to a report from Consul Davis B. Levis to the Department of Commerce, the value of the work for 1923 reaching 500,000,000 francs ($27,159,152). Repairs to dwelling houses and farm buildings, already nearly finished, will be completed in 1924. Out of a total of 33,376 dwellings, 30,560 have been repaired, 5,439 of these during 1923. The figures for farm buildings are: total, 16,897; repaired, 12,866; during 1923, 3,252. Some dwellings and farm buildings never will or can be repaired, for various reasons. It is significant that in both rural and town dwellings much attention is being paid to sanitation and modern conveniences. Fully 92 per cent of the new structures are of brick.

Station Designed for Occasional Crowds at Champaign

Layout Made for Normal Service But Can Handle Large Numbers—Grade Separation Work Facilitates Improvement

AN IMPORTANT improvement in the Illinois Central R.R. facilities at the university city of Champaign, Ill., is the elevation of its tracks and the construction of a new passenger station with the unusual feature of having station tracks at two levels; high-level tracks with an island platform between the passenger tracks for the regular and through service and ground-level tracks and platforms for use at times when great crowds assemble at the university. Grade-crossing elimination on five of the principal streets of the city of Champaign was carried out as part of the improvement.

The city is a division point on the Illinois Central R.R. and the railroad traffic averages 18 passenger and 30 freight trains daily. Taking the twin cities of Champaign and Urbana as a unit, the permanent population is about 28,000, exclusive of the student body at the University which numbers about 9,000.

Until the recent improvement was started the Illinois Central ran through the city at grade, its profile being a long sag which lent itself readily to track elevation and grade-crossing elimination. The revised profile is an improvement over the old profile insofar as the northbound or heavy-haul freight trains are concerned and only interposes two short and unimportant pieces of increased grade against southbound traffic, 700 ft. of 0.6 per cent and 500 ft. of 1 per cent grade. These grades were necessary because the beginning of the ascent to the elevated track was fixed by two crossings of other railways where the expense of grade separation is not warranted at the present time. The main line is double-tracked except between the freight yards north and south of the city, where it is four-tracked, the two east tracks being used for freight service. For about 800 ft. at the north end of the new work, extending through the station, the four elevated tracks are on an earth fill, confined on the station side by a concrete retaining wall, as shown in Fig. 1. The highest lift of the new track above the original ground level at this point is 9 ft. For the remainder of the new work, about 9,000 ft., the fill is in the open right-of-way and is unrestricted. The lift on this section averages from 5 to 8 ft. Industrial tracks at ground level are reached by descending grades of 1 per cent.

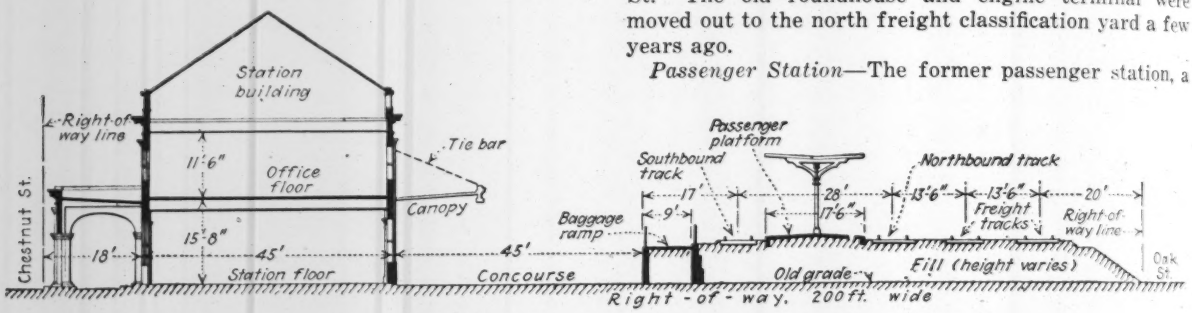


FIG. 1—CROSS-SECTION OF TRACK ELEVATION AT CHAMPAIGN STATION

Track and Station Layout—The new layout is shown in Figs. 1 and 2. The main-line passenger tracks are served by an island platform 17½ ft. wide and 1,500 ft. long and by a separate baggage platform. The passenger platform is reached by a subway from the open concourse in front of the station building and has extra exit stairs guarded by turnstiles at the Main St. foot passenger subway, and at the University Ave. subway. The main floor of the station building, the open concourse, and the stub track at the north end of the passenger station are at the Chestnut St. level, with only a few steps down to the depression of University Ave. where it enters the subway. This arrangement of a large open concourse and adjoining stub tracks and platforms all at street level is designed to handle the crowds attending games or special exercises at the University. As the restricted right-of-way adjacent to the passenger station did not permit the building of the estimated amount of emergency platforms, additional ones were built between the team tracks in the new local freight station yard which occupies the site of the former roundhouse and engine terminal, a short distance south of the passenger station along Walnut St. The old roundhouse and engine terminal were moved out to the north freight classification yard a few years ago.

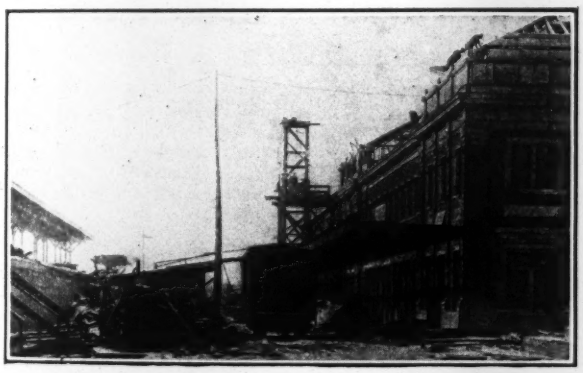
Passenger Station—The former passenger station, a brick building, has been moved from its position across the end of Main St. to a position along the stub passenger tracks where it will serve as a mail and express building. The new station has been built between Main St. and University Ave., facing on Chestnut St., and Main St. has been opened for foot traffic only by a small subway under the four main-line tracks. The new two-story station is of steel-frame construction 290x46 ft. with walls of red brick, white stone trim, and a red tile roof. The lower floor contains the usual passenger station facilities and the upper floor is used for the division offices. Special features of the passenger facilities are the large waiting room, 106x30½ ft., and a reception room for the convenience of students and other passengers arranging for long trips.

A convenient method of handling baggage, mail, and express matter from the main-line trains is provided by a 3 per cent grade ramp along the west wall of the track elevation extending from the concourse to the baggage and passenger platforms. Baggage trucks are hauled by one-ton gasoline tractors with trailers. This arrangement avoids the use of elevators and gives greater capacity and speed of service.

Subways—The new work includes the construction of four new vehicle subways, the alteration of two existing vehicle subways, and the construction of a passenger subway at Main St. One vehicle subway is at the junction of University Ave. and Chester St. and thus

actually serves two streets. It is shown in Fig. 3. For the Main St. subway steel columns and cross girders carry a deck of longitudinal I-beams incased in concrete. All other subways are built according to the Illinois Central standard of precast deck slabs supported on concrete abutments and street bents poured in place. Streets having surface car lines are given a minimum headroom of 15 ft. and other streets a headroom of 12 ft. A maximum grade of 4 per cent was used for roadways and of 6 per cent for sidewalks.

Lowering the streets for subways necessitated the construction by the railroad of 1,450 ft. of 15- and 24-in. sewer parallel with and on the east side of the track.



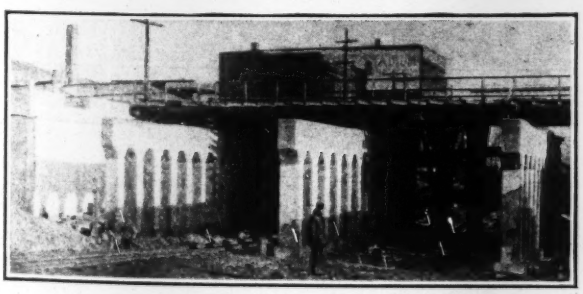


FIG. 3—TRACK ELEVATION AT CHAMPAIGN, ILL.
Above: Elevated track at left with temporary steps; concourse in middle at street level (obstructed temporarily by building material and construction track); new station at the right. Below: Typical subway, University Ave. and Chester St.

Construction Work—For the track elevation work two of the main tracks were shifted to temporary locations, while half of the new subways and fill was being built. When this half was completed trestles

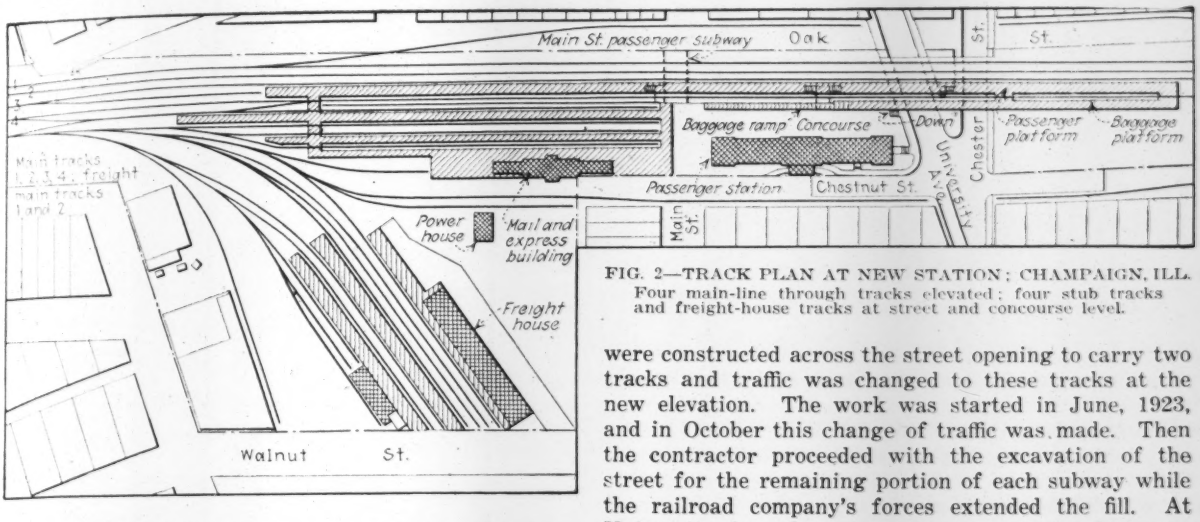


FIG. 2—TRACK PLAN AT NEW STATION; CHAMPAIGN, ILL.
Four main-line through tracks elevated; four stub tracks and freight-house tracks at street and concourse level.

were constructed across the street opening to carry two tracks and traffic was changed to these tracks at the new elevation. The work was started in June, 1923, and in October this change of traffic was made. Then the contractor proceeded with the excavation of the street for the remaining portion of each subway while the railroad company's forces extended the fill. At University Ave. there is a street-car track which was lowered to the new grade in this subway on the day the railroad traffic was shifted to the new grade. This change required 13 hr. from the time the street cars stopped operating on the old grade until they started to run over the new (temporary) track in the street at new grade.

In the case of the two old subways the existing structures will be used as far as possible and advantage will be taken of the increased headroom to improve the grade of the street.

About 100,000 cu.yd. of material were hauled 25 miles from Paxton, Ill., where grade reduction work was in progress, to make the fill at Champaign; 30,000 cu.yd. of additional material were obtained from the excavations for the new street subways and 20,000 cu.yd. from a borrow pit at Champaign. For the subway excavation, small revolving steam shovels were used, loading wagons which hauled the material to where it was used on the fill.

Engineers and Contractors—For the subways, including excavation, concrete, street alterations, and paving on approaches, the Bates & Rogers Construction Co., Chicago, had the contract. The Ellington Miller Co., of Chicago, had the general contract for the new station and interlocking tower. The sewer work at the subways was done by Christensen Bros., Champaign. The railway company forces hauled and placed the filling material, except the material from subway excavations, did all the trackwork, built the temporary trestles at the subways, and placed the concrete deck slabs and steel spans over the streets. They will also do the work in connection with the new signals and interlocking plant.

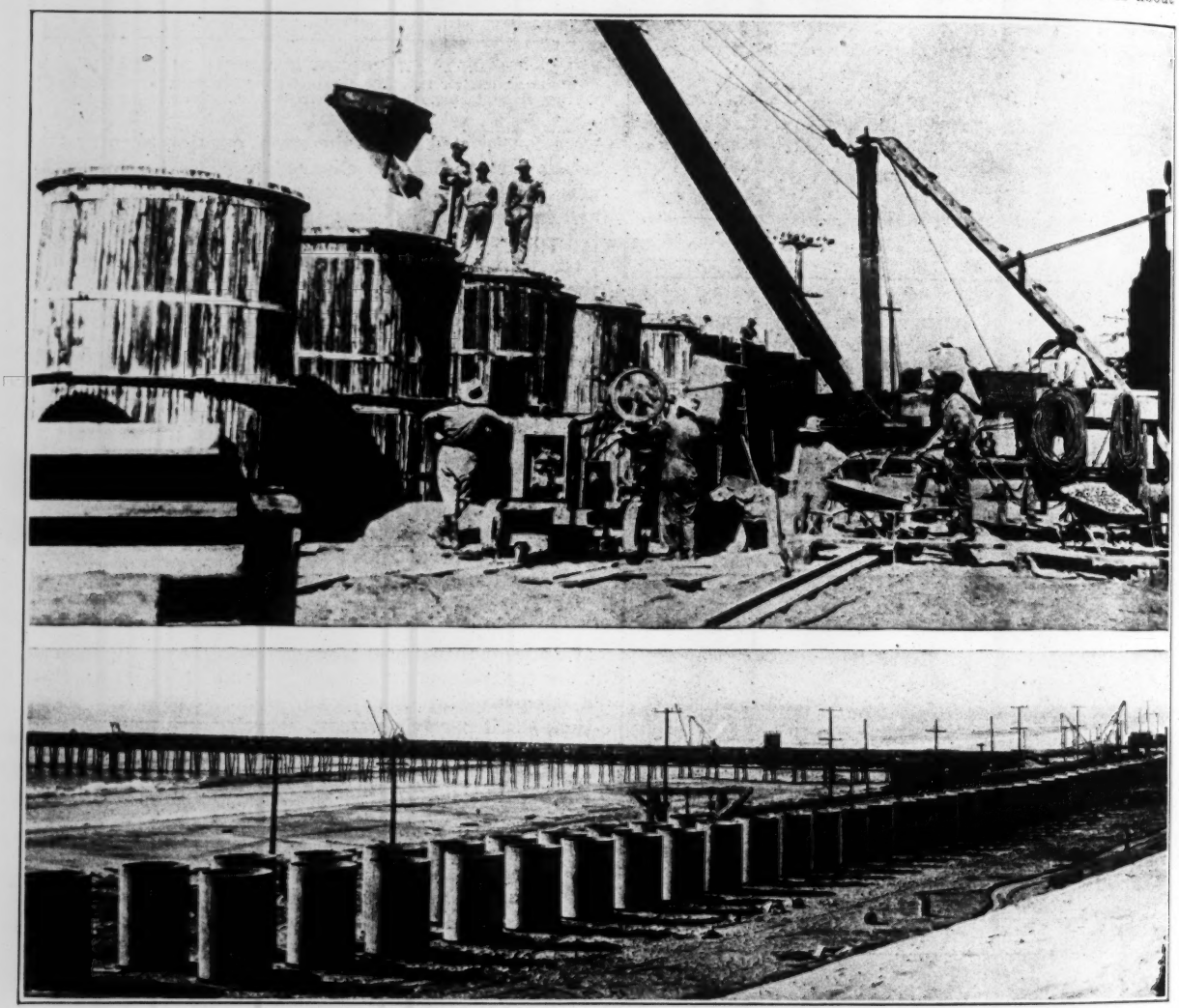
For this Champaign improvement, the design and construction are under the direction of F. L. Thompson, chief engineer, Illinois Central R.R., with O. T. Dunn, assistant engineer, in resident charge of construction. The total cost will be about $1,100,000 of which the city of Champaign will pay $165,000 towards the cost of subways. It is expected to have all the work completed by September, 1924.

Making the Concrete Pipe for Los Angeles Outfall Sewer

Concrete Put Into Forms Only as Fast as Tamping Is Completed—Four 18-ton Sections Poured Daily—Joints Designed to Retain Asphalt—Gantry Used to Lay Section on Side

THE OCEAN outfall now being constructed at Hyperion for the new Los Angeles sewer system will extend 5,400 ft. into the ocean and will consist of a reinforced-concrete pipe 7 ft. in diameter inside, which is being made in sections in a casting yard nearby. The sections are 12 ft. 3 in. long and weigh 18 tons each. Because of the different kind of organization and equipment required, separate contracts were awarded for the manufacture and for the placing of these outfall sections. The following deals only with the design and manufacture of the pipe. Reasons for the decision to use concrete instead of metal for this outfall were published in *Engineering News-Record*, May 10, 1923, p. 825. Clay tile liners are used in the upper reaches of this sewer line, as noted in the article, July 31, 1924, p. 189, but they were not used in this outfall section.

The contract for manufacturing 429 standard sections and specials was awarded last January and the work has been under way continuously since that date, the plan being to allow a minimum of three weeks for the pipe to cure before placing operations were begun. Based on the contract price plus all incidental items, the cost of this pipe including special sections is about $28 per foot lying in the yard ready to be moved into place. The normal rate of progress, once the casting yard force was broken in, was about four sections per 8-hr. day.



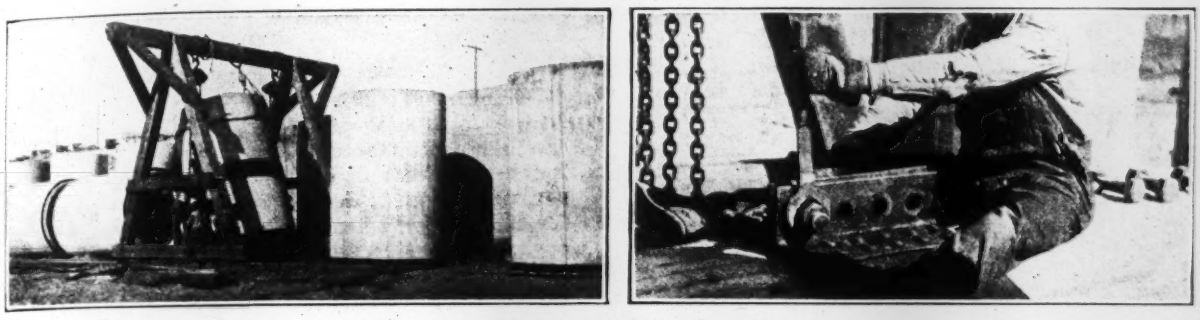
CASTING AND STORING THE PIPE SECTIONS

Above: Concreting plant and forms for pipe sections; the derrick delivers concrete to the forms on top of the sections, where workmen distribute it into the forms and spade it down.

Below: Casting yard, showing the completed pipe sections; four rows of pipe sections are to be built in the foreground by the movable mixing plant; the old sewer outfall is on the pier in the background.

The walls of the pipe are 9 in. thick and contain two "cages" or reinforcing systems made up of ⅝-in. wire wound spirally on ¾-in. square bars. The wire windings are 4 in. apart except at the ends of the cages where the spacing is gradually reduced to 2 in. to increase the strength at pipe ends. The ¾-in.

bars are spaced on 12-in. centers. All intersections of wire and rods are electrically welded. As compared to the use of tie wires, the electric welding was found to be quite as quick and it gave greater rigidity to the cage, thus facilitating handling. Moreover, the absence of tie wires was an advantage in that this cause of interference in tamping concrete around the reinforcing was removed. A plastic welding machine was used for this work. With it one man and two helpers would ordinarily assemble the steel on jigs and make about 2,000 welds per 8 hours.



TIPPING THE PIPE SECTIONS AFTER CURING

Left: Gantry tipping pipe section after curing; these sections are 12 ft. 3 in. long and weigh 18 tons each; they were turned on the side and the bases were removed ten days after the concrete was poured. Right: Detail showing band used in turning the pipe sections; the four bolts clamp the girdle tightly in place, thus affording a firm hold for lifting the section; steel supports from girdle to bottom hold the ring in place while the section is turned.

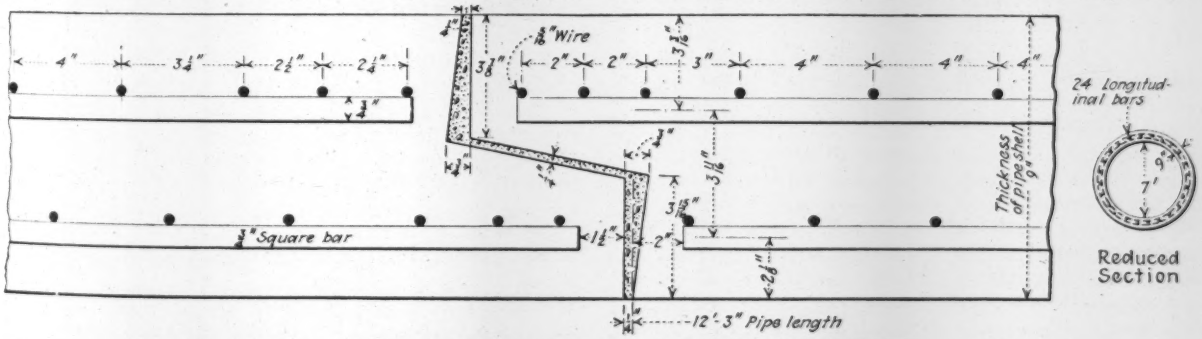
Concrete Plant—The concrete mix used was 1:1½:2½, using either crushed rock or water-worn gravel aggregate, graded from ¼ to 1¼-in. sizes, the plan being to secure the maximum density so as to protect reinforcing from sea water, this outfall being always below low tide. The materials were delivered to stock piles along the graded sand bench where the row of pipe sections was to be built, and from these piles were conveyed by wheelbarrows to a portable mixing and hoisting outfit. A gasoline-driven concrete mixer of 2-sack capacity (about 6 cu.ft. per batch) was mounted on wheels so it could move ahead as work progressed. With the mixer a steam winch and stiff-leg derrick mounted on a platform was also moved along the row as the work progressed, using a track of 18-ft. gage laid for that purpose. The function of the derrick was to raise the concrete to the top of the forms using a hopper with radial-gate bottom. The mixing crew included a foreman, 4 wheelbarrow men, one derrick man, one mixer man and two helpers.

Forms—Each pipe section was built up on a cast-iron base placed on a carefully leveled platform of 2-in. plank, the base being designed to form the desired shape of pipe end. The ends of the sections are so shaped that a double ring of the asphalt compound used to maintain tight joints will always remain between abutting ends, even though enough longitudinal pressure is exerted to squeeze out part of the compound and bring adjoining pipes to a "concrete-against-concrete" bearing.

The pipe sections were poured in a single lift, i.e., the forms were built up at the outset for the full length of each section. The inside forms were made up in segments and held in place by means of an internal collapsible frame. These inside forms were first set in place on the cast-iron bases after which the reinforcing cages were lifted to place by the same derrick used for elevating concrete. The reinforcing was held up off the metal bases by means of wood blocks but these were removed as soon as the forms were filled.

The outer forms of 2x3-in. Oregon pine staves carefully coopered to the proper curve were made up in 90-deg. segments and these, when erected on the bases, were held together by steel hoops placed around the outside and drawn up by bolts. The cast-iron bases were shaped to hold these forms in place at the bottom, one hoop was placed near the top and three other intermediate hoops were used. In addition to the hoops the forms were held by two peripheral stays consisting of ¼-in. steel plates cut to a curve so that the edges of the plates would fit against the forms. These plates were comparatively short and were slotted in overlapping sections so they could be drawn up tightly by driving wedges in the slots.

Placing Concrete—After forms and steel were in place the working platform made of wood and strong enough to support workmen and concrete was put on top of each section. This platform rested upon but nowhere extended beyond the edge of the inner form, thus making it possible to scrape concrete off the platform



SECTION OF PIPE SHELL, SHOWING JOINTS AND REINFORCING

and into the space between inner and outer forms. The desired spacing of the steel with respect to inner and outer forms was secured by means of Oregon pine rods planed to the right thickness and thrust down into the forms in groups of three. One of each three was placed between inner form and inner steel cage, a second went between the cages and the third between outer cage and outer form. By the use of several such spacers around the circumference, pulling them up as the concrete was poured, the steel was kept at the exact spacing desired without leaving any foreign material in the concrete.

Work was carried on simultaneously on two pipe sections, the hopper delivering to them alternately. This plan allowed four minutes for the distribution and tamping of each batch and, because the concrete went into the forms in a thin sheet, is believed to have practically eliminated the formation of voids. Two men worked on each platform using spades consisting of a long wooden handle terminating in a 4x6-in. metal plate, ¼ in. thick and perforated to facilitate letting air out of the concrete. These spades were used first to shove the concrete into the form, endeavor being made to secure a uniform distribution, and then the concrete was thoroughly spaded and tamped by working the tools successively inside, between and outside the steel cages. The top of each section was brought to the proper shape for jointing by the aid of a cast-iron ring placed in the top of the wood forms just before the last batch of concrete was placed.

The Curing Process—Forms were stripped after 12 to 16 hours; the sections were then covered with burlap and kept wet for 10 days. Any time after 10 days the sections were tipped over on one side and the cast-iron base rings removed, this tipping being done usually about as fast as the rings were needed for new set-ups. A total of 72 base rings were used.

The tipping rig consisted of a heavy gantry made of 14x14-in. timbers and was rolled along on timber rails straddling a row of pipe sections. A section to be tipped was first circled with a 1x18-in. iron band or girdle slung from chain blocks on the gantry and tightened up on the pipe section by means of a flanged joint and four bolts. A crew of 3 men handled this tipping rig easily and could turn over about twelve sections in an 8-hour day.

The manufacturing contract for the outfall pipe is held by John Balch, and the work is being done under the general supervision of H. A. Van Norman, consulting engineer for the city of Los Angeles, in charge of sewer construction.

Gasoline Tax Nets Indiana $4,554,544

During the first year of its application the two-cent tax per gallon on gasoline in Indiana yielded $4,554,544.18. The yield is more than $1,000,000 more than was expected. At the time the bill was before the legislature it was predicted that collection costs might reach $100,000. The actual collection cost was $6,340.96. The work was performed without a single complaint so far as can be learned. Out of the total came $73,927.61 refunds to persons who paid the tax but did not use the gasoline in motor vehicles. Of the net collection, with all expenses paid, $500,000 went to the different counties of the state for roads and the remainder went to the state highway commission.

Street Pavement Design Based on Bates Road Tests

Paducah Builds Concrete Streets—Joint Arrangement Notable — Intersections Specially Planned—Careful Finish Applied

BY J. C. KEELEY
Chief Assistant Engineer, Paducah, Ky.

CONSTRUCTION on 65,000 sq.yd. of 7-in. concrete pavement at Paducah, Ky., was begun in 1923. A careful study was made of the Pittsburg, Arlington and Bates road tests in developing the design for these pavements. These tests, however, having been made for highway paving only, involved certain conditions not applicable to city paving; therefore the design was modified to accommodate city conditions, but not to the extent of departing from the principles indicated by the highway tests. For example the writer is committed to the elimination of expansion joints in highway paving, and, to an extent, in street paving. In the paving of city streets, however, the existence of structures such as curbs, car tracks, manholes and buildings would seem to justify the use of expansion joints as a measure of protection against blow ups.

Design—Described briefly, the design consists of a

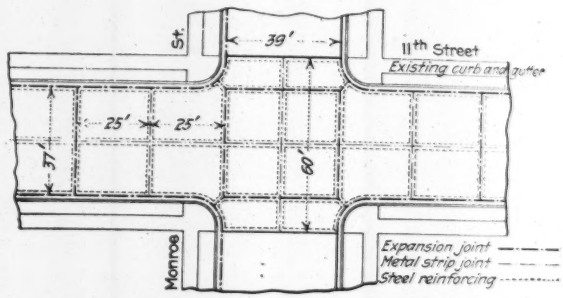


FIG. 1—JOINT PLAN FOR INTERSECTING STREETS

7-in., 1:1.7:3.5 concrete pavement with a longitudinal contraction joint through the center, and alternate transverse expansion and contraction joints at 25-ft. centers. Dowel bars are provided for all the contraction joints. The slab reinforcement consists of ¾-in. marginal steel.

Transverse expansion and contraction joints were put in at 25-ft. intervals, the joints alternating. The longitudinal joints consist of an expansion joint at each gutter line, and a contraction joint through the center when the pavement is more than 18.5 ft. in width. By this arrangement of joints, the slabs were limited to 18.5x25 ft. The height of the expansion joints was 8 in., thereby permitting the material to project 1 in. above the surface; that of the contraction joints was 6½ in. The contraction joints were of 18 gage sheet iron stamped to form a dovetail, and with holes punched at 5-ft. centers to receive the ⅝-in. dowel bars. When properly placed this material was to be ½ in. below the surface, this joint being employed to predetermine the plane of cracking due to contraction.

To reinforce the slab by protecting the edges and free corners, marginal reinforcement, consisting of ¾-in. deformed bars, was designed to be placed 6 in. inside the lines of the slabs and 2 in. below the surface.

The proportions for the concrete were chosen as a

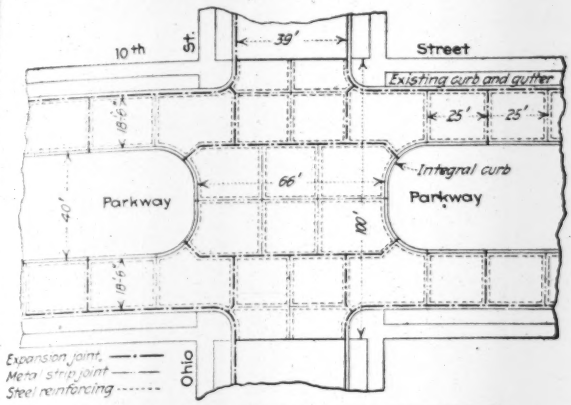


FIG. 2—SPECIAL JOINT PLAN FOR BOULEVARD AND STREET INTERSECTION

result of a number of tests made with the local sand and gravel by Lewis Institute, Chicago, Ill. It has been found since construction, that this concrete develops a compressive strength in 28 days of about 1,600 lb. per square inch, for a slump of 2 to 3 in.

All plans were made in detail, the location of all joints being shown as in Figs. 1 and 2. This was found to be very helpful, during construction, to the engineer in the field, especially at intersections. A detail plan for each intersection was made by sketching contour lines on the plan of the intersection, in which manner the grades were established. As a result although many of the intersections, covering a space 100x66 ft., were poured in four different operations, the areas as a whole present an approximately true, gently rounding surface.

A portion of the pavement was designed with an integral curb 7 in. high and 7 in. thick, with a sloping face. The curb reinforcement consists (1) of a ⅜-in. deformed rod, located in the center of the curb and extending longitudinally 25 ft. from joint to joint: (2) of ⅜-in. deformed rods bent in the form of an L and placed at 12-in. centers, extending into the slab and up into the curb within 2 in. of the top. The expansion and contraction joints in the curb match those in the pavement.

Construction—The excavation is done with a Keystone machine dumping into wagons; and, although the street material is of bank gravel well compacted, very little ploughing is necessary. After the approximate subgrade is reached, the street is rolled with a 10-ton roller until the earth is thoroughly compacted; this generally requires about six close rollings. Soft spots found in this operation are dug up and refilled with

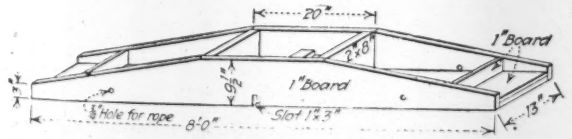


FIG. 3—DESIGN OF SPECIAL FLOAT

bank gravel and well tamped. After rolling, fine grading is done by hand. The street is rolled again with a 3-ton tandem roller immediately before the concrete.

The concrete is mixed with a 21 E paving mixer mounted on caterpillars. Sand and gravel are hauled to the mixer by six Ford trucks. The sand and gravel supply is situated at an average distance of 1 mile from the work. The trucks are of the end dumping type and are divided into two sections, each section containing 6.8 cu.ft. of sand, and 14 cu.ft. of gravel—the necessary amount for one batch. Angle iron strike-off surfaces for the sand and for the gravel are riveted to the inside of each section—the bottom portion of which carries the sand and the top portion the gravel. In loading, the driver first places the truck under the sand bin, from which it is loaded through a gate operated by means of a lever, the sand being carefully struck off to the proper height. The truck is then driven to the gravel bin where the operation is repeated. Great care is taken in getting the proper amount of each material into each section, the city keeping an inspector at the sand and gravel plant to see that this is properly done. After all the materials except the water are in the drum, the concrete is mixed not less than 1 minute (this being regulated by a timing device on the mixer), then dumped on the subgrade and spread with shovels.

A strike-off board, known as the Roughen street gage,

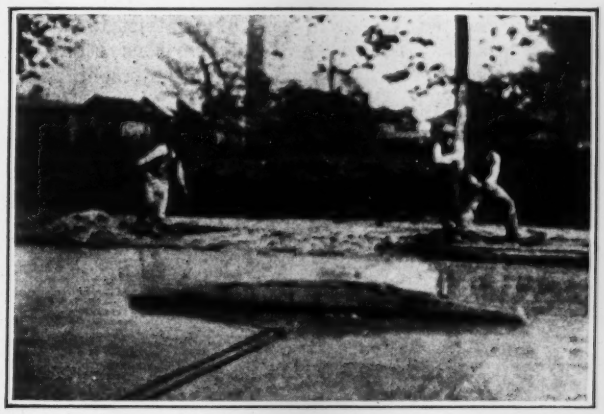


FIG. 4—OPERATING FLOAT AT A TRANSVERSE JOINT

bridging the street from gutter to gutter and operated by one man, strikes off the concrete to the approximate grade. This strike-off board is so arranged that it readily moves forward and backward, which is of great convenience and economy in keeping low places out of the concrete that would later have to be filled and surfaced by hand. Especial care is taken in spreading and spading the concrete at expansion and contraction joints, and in keeping the marginal steel reinforcement in the proper place. The concrete is placed as dry as working conditions will permit, the slump being between 2 and 3 in.

The concrete is surfaced by means of a hand roller, longitudinal float and a belt. The roller is first used to drive down all the large aggregate, after which the longitudinal float, notched to straddle the expansion joint, is dragged over the surface. This float is especially valuable in keeping the concrete at the same height on both sides of the expansion joints, taking out irregularities in the surface and bringing mortar to the top. The final finish is made with a 5-in. belt which quickly gives an excellent surface because of the previous use of the slow moving Roughen street gage, the roller and the float. While the float is being used, the surface is tested frequently with a straight-edge 8 ft. long and notched in the middle to straddle the expansion joints. After belting, the straight-edge is again used, especially at the joints. After the surface is finished the concrete is permitted to harden enough to allow the placing of burlap, which is kept damp until the

following morning, when it is removed and clay 2 in. thick is spread over the pavement. The clay is kept wet for three weeks after the concrete has been poured.

Engineering, design and suervision being done through the office of the Commissioner of Public Works of Paducah, Ky. Henry A. Pulliam is commissioner and chief engineer, and J. C. Keeley is chief assistant engineer in charge of design and construction. Yancey & Johnson of Paducah, Ky., are the contractors.

Modern Coal Handling Facilities at the Ruhr Ports

Car Dumpers and Unit-Container Cars Used to Reduce Handling—Large High-Speed Cranes Speed Up Loading

Special Correspondence

OF THE 23,000,000 tons of freight handled annually in Duisburg Harbor in the Ruhr district 18,000,000 tons are coal. The average of 60,000 tons a day requires a large amount of mechanical equipment and a minimum of rehandling. Generally, two types of handling equipment are used. These are car dumpers for handling large quantities where it is possible to dump directly into the barges from large hoppers, and unit-container cars where smaller quantities have to be handled by cranes.

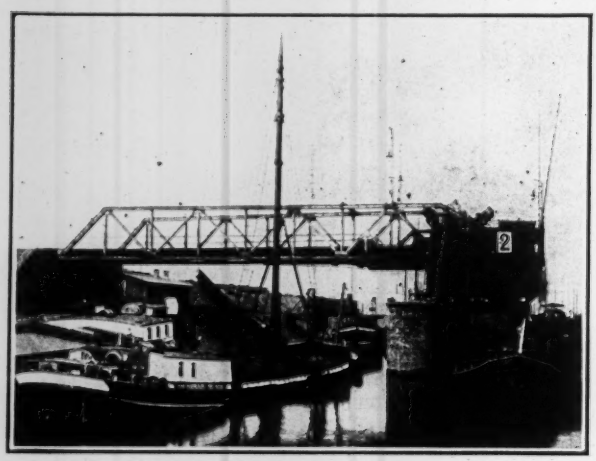


FIG. 1—CAR DUMPER BRIDGE AND HOPPER
Hopper at extreme outer end of its travel

For the electrically-operated car dumpers the 15-ton capacity coal cars are delivered to the supply tracks for the car dumpers, from which an electrically-driven capstan draws the cars onto an electrically-operated turntable, on which, firmly held by its brakes, the car is turned in the direction of the dumper and is weighed while being turned. Then the turntable track is lifted at one end and the car runs to the tipping platform. Two powerful levers grasp the front axle, the front flap of the car opens and the platform is tipped forward about 50 deg. The coal is dumped into a hopper of 70-ton capacity suspended from the lower part of the bridge. This type of car dumper is shown in Fig. 1. It is so arranged that the hopper can be moved along the lower side of the bridge to serve three lines of boats.

After the car is dumped it returns automatically to the turntable, where it is again weighed and delivered to the empty car track.

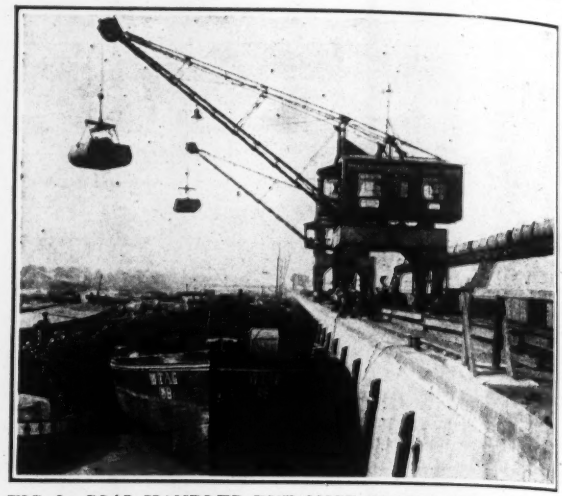


FIG. 2—COAL HANDLED BUT ONCE FROM MINE TO BARGE
Bottom dump buckets loaded on flat cars at mine mouth

Fig. 2, showing the way in which the unit container cars are used, is self-explanatory. The containers have a capacity of from seven to ten tons, and are loaded four to a standard-gage car. They are loaded directly from the sorting belt at the mine. The great advantage of this method is that the coal is not dumped during the whole operation of transferring it from the mine to the barge.

Indianapolis Garbage Trailers Drained

TRAILERS used in the collection of garbage at Indianapolis, Ind., are provided with false bottoms consisting of a perforated plate and a space below. When the trailer is a third full, two-thirds full and filled the collector in each case stops the trailer over a sewer manhole and drains out the free water that has collected in the false bottom. The jolting of the garbage in the trailer facilitates the passage of the water into the false bottom, says E. W. McCullough, consulting engineer, Board of Sanitary Commissioners of Indianapolis, in a paper read by him recently before the Indiana Engineering Society. Mr. McCullough says further:

After the garbage has been hauled to the reduction plant the water that has shaken out during the long trip by truck and trailer is drained off. As much as 150 gal. of water have been drained from a single trailer. This takes into consideration all drainage from the time the collection starts until the garbage is finally ready for dumping into the receiving station at the reduction plant. The perforated plate is so arranged that even the trailer-water receiving compartment is cleansed when the trailers are washed after dumping each load.

Prior to installing these dewatering devices the department was flooded with complaints against the spillage of garbage water along the streets. This spillage caused both odor and fly nuisances and was a real menace to public health. Since installing the dewatering device no complaints have been received in spite of the fact that each 3½-yd. water-level capacity trailer now carries a load of four tons instead of the usual 2½ tons carried when the complaints were being received.

In my opinion it is the free-water content of the garbage that causes the rapid deterioration of the solid portion. This is borne out by the fact that since the campaign of dewatering was inaugurated the odors emanating from the receiving station have been reduced to a minimum. It is remarkable to note the exceedingly fresh condition of the garbage at the time it is ready for dumping into the cooking tanks. Better results have been obtained at the plant since cooking the fresher garbage and the products are of superior quality.

Cableways Handle Excavation and Fill on Wisconsin Dam

Cofferdam Excavated and Concrete Gravel Delivered by One Slackline Cableway; Two Used to Construct Earth Dike

TWO interesting features of the new dam for the Wausau Paper Mills Co., on the Wisconsin River at Brokaw, Wis., distinguish it from numerous similar structures throughout the country. The first is its peculiar position in relation to the old dam, and the second is the method of handling the excavation and filling.

The new dam replaces an old wooden dam that has served the paper mill for many years. It is designed to develop approximately 4,000 hp. under a 17-ft. head. The structure itself is not unusual; it consists of a hollow concrete overflow dam surmounted by 11 Tainter

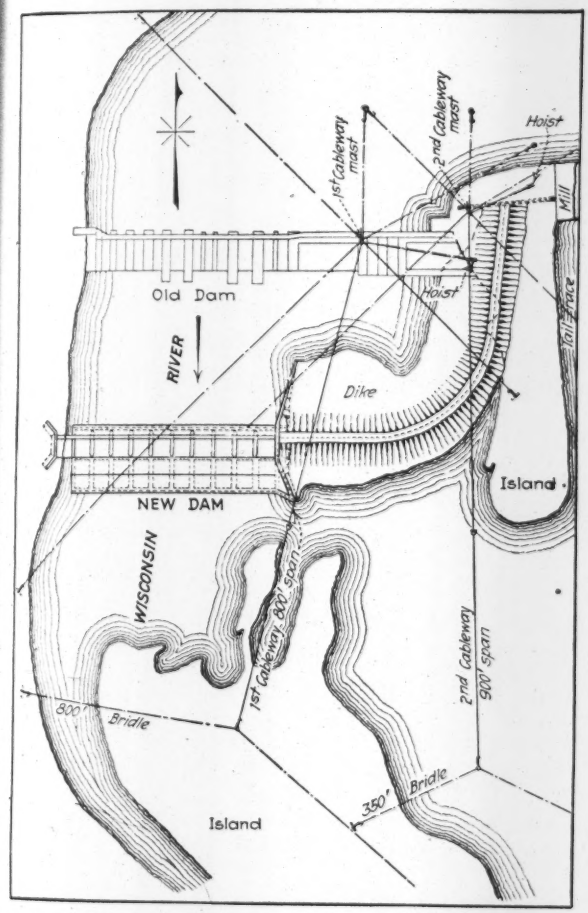


FIG. 1—OLD AND NEW DAMS AND CABLEWAY LAYOUT

gates 26 ft. long and 15 ft. high, located at the west side of the river, and an earth fill dam between the spillway and the mill which is located on the east bank of the river. The foundation material, except at the west bank, is of sand and gravel of an unknown depth. At the west bank there is a small outcrop of rock. In order to prevent a dangerous flow of water through the gravel under the dam, two rows of interlocking steel sheetpiling were driven under the spillway section below the cutoff walls at the toe and heel of the dam. The upstream row of sheetpiling is continued through the earth fill as a core wall. This piling is 65 ft. long and is driven to about 40 ft. below tailwater level. A concrete apron was laid on the river bottom below the spillway. Sheetpiling under the spillway and apron was driven to a depth of 25 ft.

Economic considerations, rather than physical conditions, determined the position of the new dam. The obvious place to locate it from a physical standpoint would have been directly behind the old dam, where the stream was shallow and where the length of the earth embankment between the spillway section and the mill would have been at a minimum. But to locate it in that

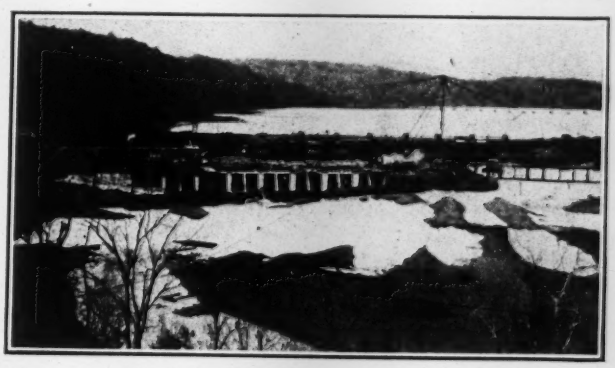


FIG. 2—OLD AND NEW DAMS AND CABLEWAY EXCAVATOR
Upstream view.

position meant that the mill would have to be shut down for several weeks and the owners concluded that it would be cheaper to build the dam farther downstream where the water was from 25 to 30 ft. deep and where the earth embankment would have to be considerably longer in order to connect the new dam with the old one at the mill, done in order to maintain the original tailrace.

The preliminary studies of the site revealed the fact that sand and gravel for making the dike could be obtained from deposits in the stream a few hundred feet below the dam. To get at this material a slackline cableway excavator, with a 90-ft. built-up timber mast and 800-ft. span, and operating a 1-cu.yd. bucket, was set up on the old dam while the cofferdam for the new structure was being driven. When the latter was completed and ready to be filled it was found that the cableway excavator could also be used to excavate inside the cofferdam where it would reach the greater part of the material to be moved. Moreover, the excavator was able to get good concrete gravel from the deposit in the river and to deliver it to the mixing plant inside the cofferdam.

The original plan was to use but one cableway for the whole earth fill, moving it eastward after the larger part of the material had been placed from its first position. But winter was at hand before the fill was started, and, in order to get the necessary 40,000 cu.yd. of material in place before the spring floods, a second excavator, similar to the first, was set up east of the original one, as shown in the accompanying drawing.

The mast of the original cableway rested on cribbing near the middle of the old dam and its bridle cable was anchored so that the line of operation of the bucket could be swung at a wide angle from the west bank of the river over across the largest of the gravel deposits in the stream. The second cableway was erected near the eastern end of the old dam and its excavating was mostly along the bank of the stream. This second cable-

way has been left in place, as it is so located that it can be used this summer to deepen and straighten the tailrace in order to increase the head on the plant about 17 in.

One interesting feature of the construction of the earth dike is that the major portion of it was made during the winter months, when the temperature frequently went from 10 to 35 deg. below zero. Despite this handicap, the work was carried through to a successful conclusion before the spring floods.

The total amount of material handled was 12,000 cu.yd. of aggregate for the concrete work, 8,000 cu.yd. of material for the cofferdams, and 40,000 cu.yd. of fill for the dike. The total cost was approximately $500,000.

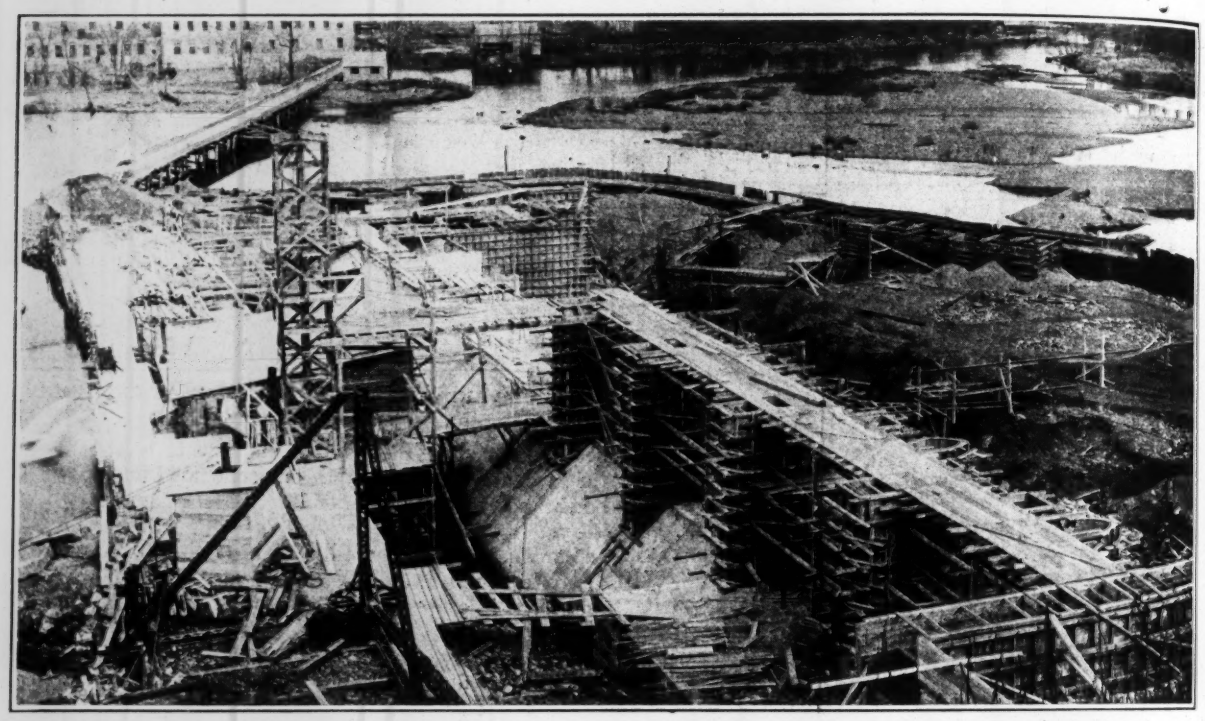


FIG. 3—SPILLWAY SECTION OF NEW DAM, SHOWING PLANT LAYOUT FOR HANDLING CONCRETE

The new dam was designed by L. A. De Guere, architect and engineer, Wisconsin Rapids, Wis. Work in its early stages was carried on by William Uhle, a contractor, and later by the Wausau Paper Co. with its own forces under the direction of Fred Boyce, mill superintendent, and T. L. Edmonds.

Railway Electrification in Japan

A program for the electrification of the Tokaido Railway lines between Tokyo and Akashi, Japan, was approved at a recent Imperial Government Railway Conference, held in Tokyo. The money for this electrification was appropriated some time ago, but nothing had been done pending the adoption of a definite program. The work under consideration at the present time consists of the portion of the Tokaido line extending from Numazu to Akashi, a distance of approximately 300 miles. Not including the cost of locomotives, this work will require an expenditure of approximately $10,700,000. Future work will include not only the Tokaido lines but also the Central and Northern Lines, for which tentative plans for electrification have already been prepared.

Activities of Los Angeles Regional Planning Commission

FORMATION of the City & County Engineers' Association to serve as technical advisers to promote the co-operation of the forty cities and fifty unincorporated towns in the area of its jurisdiction was one of the first accomplishments of the Los Angeles County Regional Planning Commission, established in January, 1923, by the Board of Supervisors of Los Angeles County. The Commission is an advisory body to the Board of Supervisors designed to assist the board in the exercise of the authority of the county in unincorporated territory and to further "concurrent and co-operative action on the part of the municipalities of the county." The Commission consists of five members appointed by the County Board of Supervisors, each representing the five supervisoral districts of the county. Among the members are Prof. George A. Damon of Pasadena, and Hugh R. Pomeroy of Redondo Beach, the latter serving as secretary of the Commission (offices, Hall of Records, Los Angeles). The first annual report of the Commission was submitted to the National Conference on City Planning in Los Angeles in April.

In addition to promoting the organization of the city and county engineers' association already mentioned, an early activity of the new commission was recommendations that led to the adoption by the County Board of Supervisors of a regional highway plan. Still another early activity which promises to be of much importance is work for the control of land subdivisions. Transportation and sewage disposal are also studied.

The County Regional Planning Commission is an outgrowth of a series of Regional Planning Conferences, promoted by a voluntary organization that met from time to time in 1921 and 1922.

Notes from Foreign Fields

Advertising in the Economic Scheme —A Suggestion to the Engineer

By E. J. Mehren
Vice-President, McGraw-Hill Co.

As WAS stated in my first letter, there met in London last week an international advertising convention —the largest in fact ever held by the Associated Advertising Clubs of the World. To me the importance of the meeting lay not so much in what was contributed on the mechanics of advertising as in the view of this new—or relatively new—business force taken by British business men and statemen, heirs as they are to centuries of business tradition.

I include the British statesman as an heir to British business tradition advisedly, for British diplomacy has ever been affected—some will say motived—by trade considerations. This was to be expected in a country so dependent on foreign trade. Moreover, statesmanship at home in an industrial country must envisage business and its methods for they inevitably and powerfully affect social conditions. The views of British statesmen regarding advertising, therefore, are of much importance.

My expectation that the meeting would be interesting from this point of view was not disappointed.

Advertising and Distribution Economics—The analyses made, moreover, are of interest to American engineers as well as to American industrial managers and business men, for while the function of distribution is in accord with the principle of division of labor, separated from production, the two are, economically, inseparably bound together. Of what use to produce, if the product cannot be sold? Of what value to reduce manufacturing cost, if all the savings are to be negatived by a wasteful distribution system?

Let it be said at once, then, that the leaders in British business and statesmanship do accept advertising heartily, as a valuable ally in the distribution of goods. It was natural, too, that the speakers should often speak of advertising in its relation to foreign selling, for before the war 45 per cent of Britain's industrial production was sold abroad.

The analyses made were quite fundamental. The Prince of Wales himself in his opening address put the fundamental of advertising succinctly when he said that its purpose is "to provide throughout the world a more free exchange of commodities by a lower cost of distribution."

Note here, in passing, the words "throughout the world"; just a touch, it is true, but the sort of thing that recurs again and again in a business day in England to denote that the Englishman's habit of thought on business and statesmanship is international—quite by contrast to our own, though we have made great progress since those startling days at the close of July and the beginning of August ten years ago.

Winston Churchill brought out the function of advertising with remarkable force when he inquired into the reason for the present stagnation in European business. He pointed out that Europe's economic difficulties were due to a great decline in the "consuming power, a great fall in the purchasing power, a great decline in the demand for goods and services of every kind from man to man and nation to nation." On the other hand, he argued, the world's producing power, increased by war development and by new discovery and invention, is greater than ever and is ready to come forward at any moment that the purchasing and consuming power revives. And here he turned to advertising.

"Advertising," he said, "nourishes the consuming power. It creates wants, it reveals possibilities, it spurs exertion, it brings together in fertile union what would otherwise have never met.

"Advertising is not all. There must be the spirit of enterprise, there must be confidence, there must be stability, there must be goodwill.

"But all these conditions might exist unrelated, unconnected, unless publicity, propaganda, and advertisement were brought in to unite them and fuse them into one effective whole, to make them vital and to make them active."

Surely, if this view be true, a proper appraisal of the place of advertising in the economic scheme must be the possession not only of the business man, not only of the engineer, on whose genius the industrial structure rests, but of the citizen and sociologist concerned with social progress.

Social Values of Advertising—But Mr. Churchill saw in it still further functions—as a protection against profiteering by carrying to the consumer a knowledge of the value and price of goods; as an encouragement to sound competition; as a means of improving, through the cheapening of distribution and so of the cost of goods, of the "collective material well-being" of the world's masses.

Finally, Sir Philip Lloyd-Greame brought out the point, though in this he had been anticipated by an American, James D. Mooney, president of the General Motors Export Co., that advertising was a powerful factor in stimulating men to work harder in order to produce and gain the means for buying goods so attractively advertised. Advertising stimulates desires, and the satisfaction of these desires brings forth men's thinking and productive powers.

Many other analyses of the functions of advertising were offered but these will suffice to show that British students of the subject have fathomed its purpose. Whether they have used advertising so successfully as we is open to debate. The British freely say that our practice is ahead of theirs. But even if it is, advertising has come into its own here, and where leaders, such as those quoted—and none of them are publishers —are relating advertising to its place in the economic and social system, its growth must be steady and sound.

On the other hand, if we are ahead of the British in advertising practice, all too many of our leaders in business, in industry, and in the professions have not viewed it fundamentally as have our British friends. Too many of us deprecate it, its functions and results.

The British are right. It is a tremendous force in our economic scheme. Its full potentialities have not been realized. Unfortunately, it has been misused. It has suffered, too, from the superficiality of advertising men. But the faults of its advocates and its use should not obscure its fundamental values, least of all to engineers, foundation stones as they are of the industrial structures.

First is production—but production is of no value unless there be economical distribution, and in economical distribution advertising has an important part.

London, July 20, 1924.

Measured Changes in Shape of Multi-Arch Bridge

Expected Distortion from Progressive Filling Not Verified—No Changes Found After Two Years' Service

By P. L. Brockway
City Engineer, Wichita, Kan.

About TWO years ago, following the failure of a multi-span barrel-arch reinforced-concrete bridge, the question of cumulative distortion of the successive arches by continuous placing of the spandrel fill from one end of the bridge was raised. At that time such a bridge was under construction in Wichita, and plans were laid to discover by actual measurement if such distortion actually occurred in measurable quantity. Measurements were taken also of the settlement of the arches when centers were struck.

There is nothing unusual in the design of the bridge. It consists of seven spans of variable length, increasing from 56 ft. at ends to 68 ft. at middle of crossing, c. to c. piers, by increments of 4 ft. The pier tops are at the same elevation, 9 ft. above the footings. The arches are three-centered, with fillet curves at the junction with the piers, making the forms five-centered. All arches are similar, so that the successive increase in height with span length produces the camber in the bridge as a whole. Foundations are identical except that more piles are driven under footings of long spans than under the shorter. The river bed is sand and gravel. All footings were carried to the same depth (5 ft. below the lowest point of the river) and piles were driven 18 to 22 ft. farther, to a thick layer of shale or indurated clay.

The design was based on a maximum concrete stress of 600 lb. per sq.in., and a temperature variation of 40 deg. F. each way from mean. Concrete samples developed approximately 3,000 lb. per sq.in. in thirty days in test cylinders, and several samples of the same material of different mixtures having different strengths showed a coefficient of elasticity of almost uniformly 1,000 times the ultimate strength.

All vertical deflections of the arches were measured on copper lugs set in the neutral axis in the face of each arch, one at the crown and three others uniformly spaced on each side. The first arch built had four instead of three lugs on each side, the lower lugs being just above the spring line of the arch.

Arch centers were built up of structural steel, with bolted connections, and with shoes resting on wooden wedges on 8x8-in. wooden sills which were in turn supported under each structural arch rib by pile heads resting on the projecting concrete footing. Only two sets of centers were used, extra sections being placed in the center of each for the longer spans. They proved very successful, the deflection under load being less than ¾ in. in the maximum case.

No arch centers were struck until the next arch had been poured, to avoid unbalanced thrust on the intervening pier. No spandrel walls on any arch were built until the centers were struck under it. In view of the fact that expansion joints were placed at either side of each pylon over each pier and that the spandrel walls did not join over the crown of the arch, the small settlement of the arches on taking their load made this an apparently unnecessary precaution.

The spandrel walls are of cellular construction, comprising an outside wall and an 8-in. inner wall carried up on the line of the curb and extended up to form the curb, connected by thin cross-walls extending from the arch barrel up to within 2 ft. of the sidewalk slab. The spandrel wall and sidewalk construction was started on arch 1 immediately after centers were struck, which was immediately after the barrel of arch 2 had been poured. When the spandrel walls had set sufficiently to allow removal of forms, spandrel filling was begun at once, and carried forward to completion (over arch 1 only) regardless of the state of work on arch 3. The filling was carried up equally over the two ends of the arch. The fill was wet sand, which stood on a fairly steep slope. It was placed partly by clamshell on a derrick, and partly by 1-yd. dump cars. Under the sidewalk slab the fill was kept 6 ft. below the slab in order to give room for workmen placing pipes and ducts.

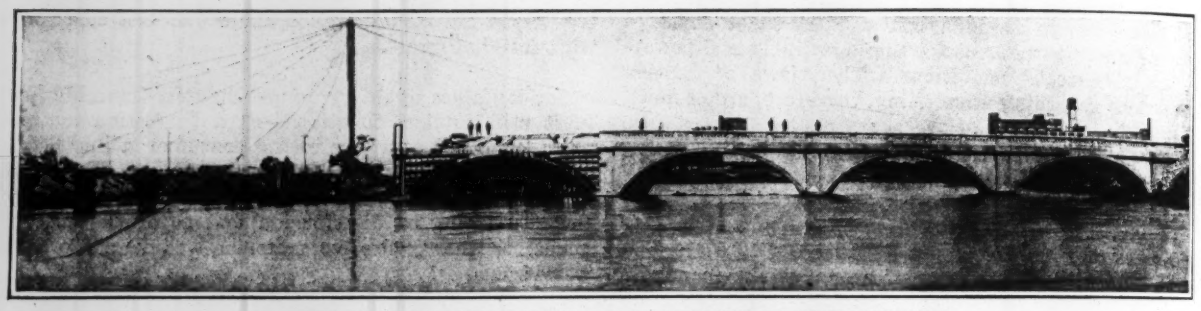


FIG. 1—MAPLE ST. BRIDGE OVER ARKANSAS RIVER, WICHITA
Completed bridge comprises seven spans of 56 to 68 ft.

High water occurring when the foundations were about half completed tied up all work in the river bed until the first half of the bridge was entirely completed ready for the pavement. This is illustrated by the view Fig. 1, which also shows the steel centering under the fourth span. The measurements were confined to the first four spans.

The arches were constructed consecutively from the abutment shown, and are numbered in that order in the table. The points in each arch are also numbered in the same direction. Point number one in each arch is used as zero elevation for that arch, although they are not all the same elevation. No material change was anticipated in the lowest points but unequal pier settlement, if any, would be shown by change in their relative elevations.

Referring to the tabulated elevations: Column I gives elevations on the morning of Dec. 20, 1921, with the placing of concrete just starting; II was taken a few

DISTORTION MEASUREMENTS ON MAPLE ST. ARCH BRIDGE, WICHITA

(Elevations in feet, read on copper lugs set in south face of arch ring; points numbered from west end)

Reading Date Condition Point		I Dec. 20	II Dec. 20	III Dec. 20	IV Dec. 21	V Jan. 10 2nd Arch Poured, 1st Arch Struck	VI Feb. 4 Pouring Arch	VII Feb. 5 Pouring 3rd Arch	VIII Feb. 20 2nd Arch Struck	IX Feb. 20 1st Nearly Filled	X Mar. 1 1st Arch Filled	XI Mar. 29 4th Arch Poured	XII Aug. 17 Bridge Completed	XIIA Aug. 17, '22	XIII June 16, '24
		1st Arch Being Poured													
Arch 1	1	0	0	0	0	0			0	0	0		0	1.20	1.20
	2	4.00	3.99	3.98	3.97	.....			3.977	3.984	3.995		3.99	5.19	5.20
	3	7.47	7.46	7.45	.....	.....			7.432	7.439	7.445		7.44	8.64	8.64
	4	9.50	9.50	9.50	9.47	9.44			9.467	9.469	9.470		9.48	10.68	10.66
	5	10.15	10.14	10.14	10.11	10.09			10.107	10.109	10.11		10.12	11.32	11.29
	6	9.47	9.47	9.46	9.44	9.43			9.437	9.439	9.44		9.43	10.63	10.61
	7	7.43	7.41	.....	.....	7.41			7.417	7.418	7.435		7.41	8.61	8.59
	8	4.08	4.06	4.06	4.05	.....			4.057	4.059	4.069		4.05	5.25	5.23
	9	0.22	0.22	0.22	0.20	0.20			0.222	0.219	0.22		0.22	1.42	1.39
Arch 2	1	.....	.....	.....	.....	0	0	0		0	0		0	4.59	4.58
	2	.....	.....	.....	.....	4.30	4.30	4.297		4.295	4.29		4.31	8.90	8.88
	3	.....	.....	.....	.....	6.49	6.48	6.462		6.467	6.46		6.50	11.09	11.05
	4	.....	.....	.....	.....	7.47	7.46	7.442		7.452	7.44		7.48	12.07	12.03
	5	.....	.....	.....	.....	6.65	6.64	6.642		6.642	6.63		6.67	11.26	11.22
	6	.....	.....	.....	.....	4.57	4.56	4.552		4.559	4.56		4.59	9.18	9.13
	7	.....	.....	.....	.....	0.34	0.36	0.332		0.330	0.33		0.34	4.93	4.90
Arch 3	1	.....	.....	.....	.....	.....	0	0				0	0	0.88	0.86
	2	.....	.....	.....	.....	.....	6.57	6.58				6.58	6.58	7.46	7.41
	3	.....	.....	.....	.....	.....	10.96	10.945				10.936	10.95	11.83	11.77
	4	.....	.....	.....	.....	.....	12.12	12.095				12.095	12.13	13.01	12.97
	5	.....	.....	.....	.....	.....	9.65	9.635				9.630	9.64	10.52	11.46
	6	.....	.....	.....	.....	.....	6.25	6.255				6.250	6.26	7.14	7.12
	7	.....	.....	.....	.....	.....	0.33	0.315				.....	—0.33	0.55	0.56
Arch 4	1	.....	.....	.....	.....	.....	.....	.....				0	0	1.31	1.31
	2	.....	.....	.....	.....	.....	.....	.....				7.015	6.99	8.30	8.29
	3	.....	.....	.....	.....	.....	.....	.....				9.91	9.87	11.18	11.15
	4	.....	.....	.....	.....	.....	.....	.....				11.94	11.88	13.19	13.15
	5	.....	.....	.....	.....	.....	.....	.....				10.63	10.59	11.90	11.86
	6	.....	.....	.....	.....	.....	.....	.....				6.685	6.70	8.01	8.00
	7	.....	.....	.....	.....	.....	.....	.....				—0.45	—0.45	0.86	0.87

hours later with the concrete just above points 2 and 8; III marked the close of the day's run, with the arch two-thirds completed, and IV was taken the next day after all the concrete was placed. There was no appreciable distortion and only 0.04 ft. settlement at the crown. Missed elevations were those made so inaccessible by braces that readings would not have been reliable. Later lugs were so set as to prevent this.

Readings V were taken Jan. 10, 1922, immediately after the centers were struck under arch 1 and a few days after the pouring of arch 2. At this time a test cylinder of the concrete in the first arch developed a crushing strength of nearly 3,000 lb. per sq.in.

Readings VI and VII were taken Feb. 4 and 5, immediately before and after placing concrete in arch 3, and before centers were struck under arch 2. An attempt was made to read closer than hundredths in VII, VIII, and IX, although it is doubtful if an accuracy of less than five thousandths was obtained. In column VI, point 7 of arch 2 shows an irregularity not checked by the behavior of arch 3, so it was doubtless an instrument error.

Readings VIII were taken Feb. 20, immediately before spandrel filling began, centers being out from under arch 2 and in place under arch 3. Comparing points 4, 5 and 6 in V and VIII makes it appear that striking centers under arch 2 distorted arch 1 very slightly, although the amount is so small that, if anything, it only tended toward its original shape as shown by similar points in Reading IV. It is possible that the heavy abutment back of point 1 in arch 1 contributed to the eccentricity when the centers were struck under arch 1, and that balance of load on the first pier overcame it when centers were struck under arch 2.

Column IX was observed Feb. 20, 1922, after spandrel filling was practically completed on arch 1, and column X on Mar. 1 after it was entirely completed. It is at this point that distortion in arch 2 should appear, if at all. Critical examination of elevations of arch 2 under VII, IX and X does not reveal it. Likewise the only change apparent in arch 1 as the load came on was a nearer approximation to the original shape shown in I as it took its load.

We therefore dismissed the possibility of distortion from our minds and filled and completed each successive arch as soon as the centers were struck in the next, as the construction of the bridge progressed.

Column XI was observed March 29, after arch 4 was poured and before centers were struck under arch 3.

Column XII was observed Aug. 17, 1922, after the entire bridge was completed and during a recorded temperature at the Weather Bureau of 100 deg. The lugs

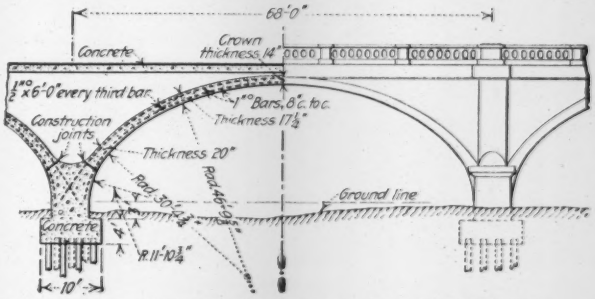


FIG. 2—TYPICAL ARCH OF MAPLE ST. BRIDGE

are on the exposed south side of the arches, where the surface temperature of the concrete was 112 deg. Spandrel filling over the arches in question was completed ready for the pavement, which was not yet placed (the pavement was constructed in September and the bridge was opened to traffic in October). There is still no evidence of greater settlement on one side of any arch more than on the other, even under the added stress of the heat expansion.

As to the temperature stress alone, arches 2 and 3 each show a rise at the crown of approximately 0.035 ft., which corresponds to an increase in length of about 0.026 ft., or 0.0004 ratio of increase of length.

Using the ordinary coefficient of expansion, this corresponds to about 60 deg. above the former temperature of the arch. It must be borne in mind that the changes of length were measured on the extreme exposed end of the arch; the part covered up would naturally show very much lower increase in temperature, so that the usual assumption of 40 deg. rise is entirely justified.

Stability in Service—Of later observations, a set of readings taken June 16, 1924, is compared with the last set in the table at almost identical temperature. The bridge is completed and has been under traffic for two years, during which time the river has been in extreme flood stage three times.

The last two readings, XIIA and XIII, are reduced to the same elevations throughout, to show the stability of the piers as well as of the arch rings.

These readings, taken to the nearest hundredth only, indicate a settlement of about two hundredths in the first and second piers and none in the third and fourth. Correcting arch elevations for these pier variations makes the vertical deflections due to the change in loading between the two readings fairly consistent. In fact the added load almost balances the expansion from temperature, making the elevations correspond to those at normal temperature with the spandrel fill load only.

There will necessarily be a number of observations made for extremes of temperature over a period of several years before conclusive deductions can be made.

We believe that we have determined, however, that the arches have retained their symmetry from their first construction regardless of any eccentricity of external stresses which have been imposed upon them.

Methods of Overcoming Silting of Reservoirs Outlined

Four Methods Considered by Water Power Survey —Development of Streams Reduces Trouble from Silt

ECONOMIC studies of the water power of Deep River in North Carolina, made by the North Carolina Geological and Economic Survey, include studies of the silting of ponds and reservoirs. The possible methods of overcoming or reducing the trouble from silt, and their availability under various conditions are given in these studies as follows:

(1) Pumping by floating dredge.
(2) Sluicing through openings in dams.
(3) Blasting in time of flood.
(4) Excavation by dragline scraper.

Each of the above methods has been considered from the standpoint of material to be removed and of cost.

Method 1 has the advantages that it could readily excavate both sand and silt; could automatically separate sand for commercial uses; and could pump silt to farms for fertilizing purposes. The chief disadvantage is due to the difficulty which would obtain in moving the pumping unit from pond to pond. It would not be practicable to use a separate unit for each pond.

Method 2 is now used at a number of ponds, but is open to two objections. The existing gates can be operated only in low-water periods when sluicing is least effective, and these gates are so small that the effect of sluicing through them is not felt to any considerable extent in the pond. As new developments are constructed, provision should be made in the dams for large gates which may be operated from the power house in time of flood. These gates should be large enough to pass a considerable portion of the flood flow; they should be placed with due regard to the direction of the current; and they should be placed high enough not to be interfered with by backwater. Gates in dams constructed with these conditions in mind have successfully controlled silting in this state and elsewhere.

Method 3 has been taken up with the powder manufacturers. The consensus of opinion is that it would prove more expensive than the other alternative methods.

The use of movable dragline excavators (method 4) appears to be the cheapest and most feasible method for silt removal in existing ponds. One such excavator of about 1½ cu.yd. capacity can be readily moved from pond to pond as conditions require. In most cases the banks are such that an excavator can work from them economically. In several places sand of good quality may be removed, and there is a ready local market for it. This would in part pay for the cost of excavation. The value of the increased pondage is easily worth the remaining cost of operation. It is estimated that on the basis of present installations at least 20,000 hp.-hr. are lost daily for 150 days annually due to inability to store night flow. At as low a cost as ½c. per hp.-hr. this amounts to $15,000 per year. The annual cost of operating the scraper would not amount to nearly this sum when averaged over several years. * * * * *

An important advantage in the high storage dams located at the headwaters will be their effect upon silting, as follows:

(1) They are strategically located to intercept silt and sand. They are large enough so that there will be a rather definite separation of sand from silt. The sand will be deposited in shallow water at the head of the ponds, where it can readily be removed and sold. The silt will be carried toward the deeper portion nearer the dams.

(2) The space for accumulation of silt is large, amounting to at least one-half the height of the dams, before the utilizable water storage volume is reached.

(3) Large gates, operated by electric power, can be placed on the dams, so that if silt accumulates it can be flushed out when the river is in flood, if this is desired.

(4) There appears to be a tendency in reservoirs of a certain size, and bearing a given relation to the size of a stream, to keep flushed out above a given level. It happens often that such a reservoir will fill to two-thirds the height of the dam with silt, but the decreased cross-section resulting from this makes floods scour out the upper third, which is all that is used for storage of water.

(5) Most of the deposits now carried by the river come from above the proposed storage reservoirs. Therefore, by building these reservoirs, the shallow ponds below would probably not be troubled again to anything like the present extent once they had the silt removed and consequently would be able to store the night flow.

It is probable that the power companies may later find it economical to adopt erosion control methods to prevent or lessen the silt and sand now being carried by the stream. On the headwaters, especially above Randleman, a reforestation policy combined with inexpensive erosion control devices would undoubtedly serve to lessen materially the very large amounts of sediment now carried by the river with resulting destruction of agricultural land. It is believed that such a policy would not prove unduly expensive, and it should be considered by any company proposing to carry out the scheme of unit development of the river. * *

The Waterpower Investigation of the Deep River is published by the North Carolina Geological and Economic Survey as Economic Paper No. 54. It was prepared by Thorndyke Saville, hydraulic engineer.

Swedish Railways Adopting New Motive Power

In addition to the electrification of main lines in Sweden, the railways are adopting motor-driven cars for the shorter hauls to a considerable extent in this service. The first Diesel motorized train was put in operation in September, 1913, and at the present time there are about fifteen of these trains in operation. These trains are competing successfully with both passenger bus lines and motor truck freight service operated over the highways in many parts of Sweden.

Survey of Stream Pollution in Ohio

IN ACCORDANCE with the direction of the State Legislature of Ohio a survey of stream pollution in that state is being made by the Ohio Department of Health under the direction of W. H. Dittoe, chief engineer, with Charles C. Hommon in immediate charge. The State Department of Agriculture is co-operating in the survey. Field work was started in April of this year and had been about one-fourth completed on Aug. 15. The object of the survey is to determine the locations of discharge of sewage and industrial wastes into the streams of the state and to determine in a general way the effect of those discharges.

The authorization for the work was the outcome of agitation before the legislature by sportsmen and others against whom were representatives of some of the manufacturers of the state. The sportsmen were endeavoring to get drastic legislation against stream pollution—apparently working along the same general lines as the Izaak Walton League which seems to have been more active in some of the North Central States than in other parts of the Union. Ohio chapters of the League and other sportsmen's organizations have been co-operating with the state health officials in attempts to ascertain stream pollution facts and there has also been like co-operation by manufacturers.

As a part of a campaign of general education the Ohio Department of Health has issued a 4-p. circular from which the following excerpts have been made:

Uses of Streams—The principal uses of our streams are for water supply, drainage and recreation. Under water supply, we must include water supplies of municipalities, institutions, industrial plants and farms, and must recognize not only use for human consumption but also other uses. The use of a stream for drainage is its natural use for removal of water running from the surface and includes also its use for removal of sewage and industrial wastes. The recreational use of a stream includes fishing, boating and swimming. Under certain circumstances the use of a stream for the disposal of sewage and industrial wastes may be legitimate and may result in no damage to other legitimate uses of the stream. However, if definite control to prevent abuse or misuse of a stream is not provided, conflicts will result and the legitimate uses of the stream may be rendered entirely impossible.

Effects of Stream Pollution—The effects of pollution vary widely, being dependent upon the volume and character of the sewage or waste and the size, character and use of the receiving stream. The principal evil effects of stream pollution are: (1) Pollution of public water supplies; (2) creation of nuisance affecting public health and comfort; (3) pollution of bathing places; (4) killing of fish and other natural stream life; (5) damage to live stock; (6) damage to property and depreciation of values; and (7) damage to recreation. The first three items are definitely associated with public health.

Remedies for Stream Pollution—When a stream is polluted by sewerage the remedy must include the construction and operation of a sewage treatment plant or the abandonment of the sewer outlet and the establishment of a new point of outlet where the sewage may be disposed of properly. If an industrial waste is causing the pollution of a stream the discharge of the waste must be entirely discontinued or a plant must be constructed and operated to provide proper treatment or modification of the waste prior to its discharge.

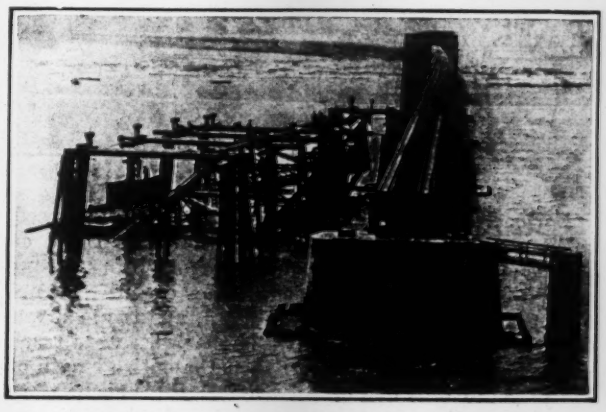
Many Grade Crossings Eliminated

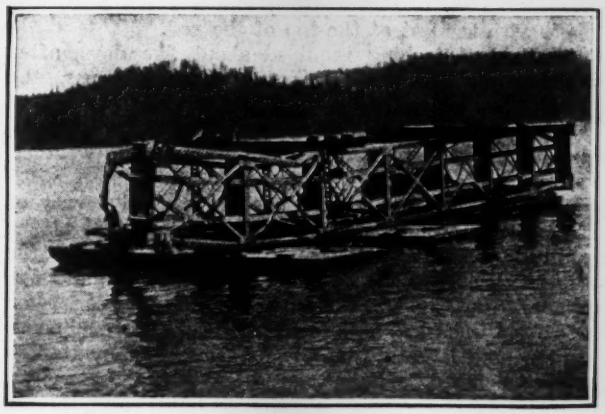
More than 3,000 railroad crossings have been eliminated on highways in 42 of the 48 states during the past five years, according to a study being made by W. C. Markham, Washington representative of the American Association of State Highway Officials. More than half were made possible by relocating the highway.

Wrecked Bridge Span Raised Bodily from Bay Bottom

Span Pushed from Coos Bay Bridge Last March Is Taken Ashore and Dissembled; Re-erection to Use One-Third New Steel

ONE OF the 180-ft. steel spans in the bridge across Coos Bay, Oregon, used by the Southern Pacific R.R., which was pushed off when a steamer collided with it last March and which has lain on the bottom since that time, was recently lifted bodily by jacks



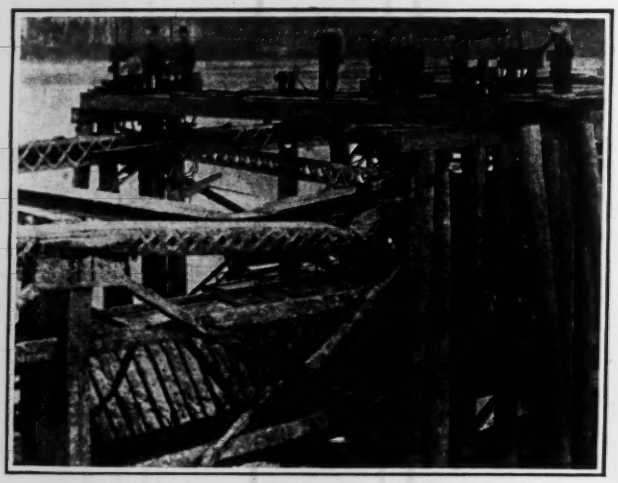


RAISING THE SPAN AND TOWING IT TO SHORE

Upper view shows general location of wrecked span, falsework in place and south end raised clear of the water. Lower view shows span on barges being towed ashore. Note kinks in portal and at both ends of the bottom chord.

supported on piling falsework, lowered onto barges and towed ashore. All steel rivets were then burned out with the oxyacetylene torch, separating the bridge members into the same units as originally shipped from the fabricating mill. In this form such steel as had not been damaged in the wreck was cleaned and repainted. Out of a total of 219 tons of steel in the structure, 75 tons was condemned. With new steel to replace damaged members the span will be re-erected on the old piers. The accident was described in *Engineering News-Record*, April 24, p. 743.

The contract for raising the span and delivering it to shore on barges was awarded to Booth & Pomeroy of Portland. The contractors drove clusters of piles along the partly submerged span which was lying on its side in 28 ft. of water and attached 1-in. steel cables at 16 points on the top and bottom chords, cable ends being attached to threaded steel rods between caps on the piles.



CRUSHED BOTTOM CHORD AND LATERAL

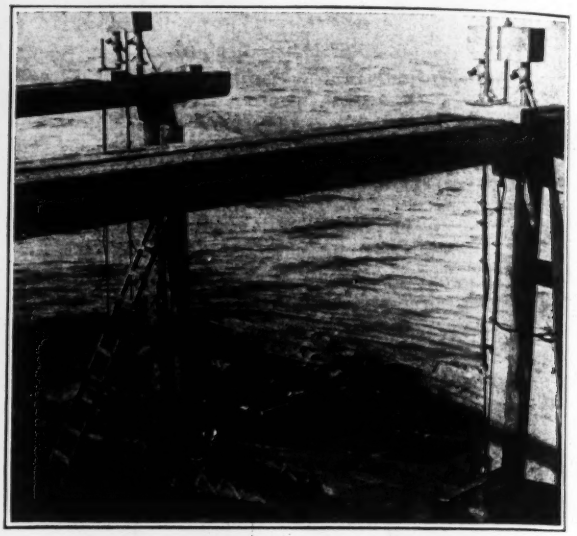
For each cable two 35-ton hydraulic jacks were used, the arrangement being such that the jacks lifted on only one cable at a time, either cable being strong enough to carry the entire load. After each lift the nut on the second rod was screwed down, and the load was carried by the second cable while the jacks were reset. After a number of lifts and when the entire length of the threaded rods had been traversed, cable connections were renewed, one at a time, and a fresh start was made with the nut at the top of the rod.

The actual jacking required about five days, after which three barges were floated under the span, the weight was lowered onto them and the span was towed ashore. The entire job of raising and delivery to shore, delayed somewhat on account of unfavorable weather, was completed in about four weeks.

When the span was ashore where careful survey of its condition could be made it was found that at the point of collision with the prow of the steamer the bottom chord and one lateral had been crushed, and, due either to the collision or to impact with pier, cofferdam or bottom such bad kinks had been caused in end posts, girders and laterals that the tonnage mentioned above was condemned.

Not only at the point of collision but also at the far end of the bridge was the bottom chord kinked, probably due to striking the remnants of the old cofferdam around the concrete pier. The entire bottom chord on one side was therefore renewed as well as about one-third the bottom chord on the other side.

An entirely new system of laterals was called for because in addition to the twisting and kinking which occurred in these sections more extensively than in the heavier members, wherever there were narrow spaces between angles or plates, such as occur frequently in light bracing members, the spaces had been filled with marine growth and in these protected places there was no opportunity to remove the growth and repaint the metal. In salt fog regions, such as the location of this bridge, metal protection is considered very important.



TYPICAL ARRANGEMENT OF CABLES AND JACKS

In the 3½ months during which this bridge was submerged and although it was thickly encrusted with marine growth the inner coating of red lead paint had not been penetrated. However, so firmly had the crustaceans clamped themselves to the steel that sand-blasting and live steam jets were not sufficient to remove them and the use of hand chisels was also necessary. When finally cleaned off, the metal was promptly repainted.

The falsework that has served to carry railroad traffic since the span was wrecked will also be used in the re-erection of the span, which will be assembled in place.

Cleaning and re-erection of the span are under the general direction of W. H. Kirkbride, engineer, maintenance-of-way and construction, Southern Pacific R.R.

TYPICAL ENCRUSTATION OF MARINE GROWTH

Malarial Control, St. L. & S. W. Ry.

The St. Louis & Southwestern Ry. maintains a special sanitary department to look after the health of its track forces. In the company's annual report it is stated that during 1923 the work of malaria control was carried on successfully. The distribution of quinine to track forces was extended and is now made to track maintenance employees on 945 miles of line. For the four-year period 1913-1916, prior to the inauguration of this sanitation system, an annual average of 602 employees were treated for malaria at the company's hospital. During 1923, there was a total of only 70 malaria cases. This work is under the direction of H. W. Van Hovenberg, sanitary engineer of the St. Louis Southwestern Ry.

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Mapping Large Areas of the Earth

Sir—In the review by Mr. Mitchell of Mr. Lambert's monograph, Effect of Variations in the Assumed Figure of the Earth on the Mapping of a Large Area (*Engineering News-Record*, July 17, p. 111), there is this paragraph: "But even more serious might be the difficulties arising where a given boundary is defined as a stated parallel or meridian and a shifting to a new spheroid of reference displaces that line so that it no longer coincides with the line on the ground. Complications difficult to foresee might easily arise from such a case."

Where a line defined by geographic co-ordinates had been selected bu not located before the adoption of a new spheroid of reference there might be some question as to the intent of those making the selection but where the line has been located on the ground and adopted no question can arise. This is true whether the relocation is made from existing marks or references or from geographic co-ordinates, as the same system that was used in the location will have to be used in the relocation.

This will hold for all countries that draw their legal principles from English law and while international law does not come from this source its principles, in so far as boundaries are concerned, are in substantial accord therewith, as may be seen by reference to treaties, proceedings, etc., in boundary disputes.

The paragraph is not applicable as an argument concerning the adoption of a new spheroid of reference.

Easton, Md., July 18, 1924. R. H. BLAIN.

Sir—The writer is in full accord with the first three paragraphs of the foregoing letter from R. H. Blain, whose long and successful service on the survey of the boundary between the United States and Canada and on the resurvey of the Mason and Dixon line is so well known. But the writer is unable to agree with Mr. Blain's conclusion and still feels that the quotation taken from the book review of July 17 is a fair statement of possibilities.

That actual procedure does not always follow the course indicated by Mr. Blain when he writes, "the same system [of geographic co-ordinates] that was used in the location will have to be used in the relocation" may be easily shown by a single concrete case. In the "Report of the Boundary Commission upon the survey and re-marking of the boundary between the United States and Mexico west of the Rio Grande, 1891 to 1896," Part I, Section 10, under the heading, "Methods used for fixing the boundary in the original survey, 1849-1856," occurs the following statement: "A tangent to the parallel 31° 47′ was laid off and prolonged westward, and Monuments Nos. 2 and 3 were set by offsets from same, using the Bessel spheroid to compute said offsets." In Part II, Chapter IV, of the same volume, which gives the report of the American section of the commission on the retracement of the boundary in 1891 to 1896, one finds that "Clark's 1866 spheroid" was used in the geodetic work, which included "I. Tracing parallels 31° 47′ and 31° 21′ by means of tangents to the prime vertical at the points of beginning and offsets from the same."

But it was not so much the question of discrepancies which might occur through the use of different spheroids as indicated above that the writer had in mind when he wrote the lines with which Mr. Blain disagrees. He was thinking of something more vague and intangible—something with greater possibilities for future trouble—the introduction of another point on which to hang disputes or to foster disagreements.

The establishment of a boundary parallel wholly as a geodetic arc is something rather new in this country, but the writer firmly believes that it is a procedure which will be more and more used in boundary location in the future, particularly in state and county boundaries. Imagine, then, if you please, two neighboring states having for boundaries geodetic arcs on different spheroids of reference; or to go even further, think of many of our states with boundaries established some on one spheroid and others on a different one, and it would seem most apparent that such a condition is one to be earnestly avoided—a condition that could easily be provocative of disputes, both costly and unprofitable.

HUGH C. MITCHELL,
Mathematician, Division of Geodesy,
U. S. Coast and Geoditic Survey.

Washington, D. C., Aug. 1.

Using the Tides to Develop Power

STUDIES IN TIDAL POWER—By Norman Davey, author of "The Gas Turbine." London: Constable & Co., Ltd. Cloth; 8 x 10 in.; pp. 255; 56 line drawings; 66 charts of bays and estuaries. 32s. in England.

Those who are skeptical about the possibilities of developing power from the tides should read this clear exposition of the theory of tidal power, for, although the book is written with particular reference to the British Isles, the chapters on tidal phenomenon, on theoretical and practical considerations of the tidal basin system, the tidal power plant, and economic conditions, have a general application, except that the chapter on practical considerations is based largely on specific estuaries in England.

As a preface to his survey of tidal conditions in the British Isles, the author gives a brief account of tidal conditions throughout the world, with a map showing the location of places having an unusual tidal range and a table of the principal locations throughout the world where the mean tidal range is over 20 ft. This is followed by descriptions of numerous proposed power developments in tidal estuaries in the British Isles. The 66 plates give data concerning all the tidal estuaries and similar indentations of the coast of the British Isles where the conformation of

the land lends itself to the construction of plants for the development of power from the tides.

In conclusion, the author, to use his own words, throws a little cold water in the face of the enthusiastic. He points out that little can be expected in the way of coal saving from this source because the total maximum output of tidal power plants in Great Britain would only make a reduction of 6½ per cent in the coal output of the country, because a relatively small amount of the total output is used for the generation of electrical energy. He does, however, point out that this maximum amount of power to be obtained from tides is no inconsiderable figure, that it is at least twice the present output of the coal-fired electric plant. To his mind, the greatest obstacle to the development of tidal power will be found in dealing with the vested interests affected by such schemes. At the time of railway development, for instance, the compensation to vested interests laid a financial burden upon the railways which remains to this day. The author considers that without government intervention similar action will imperil any scheme for the development of tidal power.

Municipal Bond and Tax Legislation

DIGEST OF STATE LAWS RELATING TO TAXATION AND REVENUE, 1922—Compiled with relation to statistics of taxation and revenue published by the Bureau of the Census in connection with the Decennial Report on Wealth, Debt, and Taxation. Cloth; 6 x 9 in.; pp. 544. $1 from Superintendent of Documents, Washington, D. C.

Engineers engaged in the state and municipal service and in work for drainage, irrigation, and other districts will find this compilation useful. Besides summarizing statutory provisions governing indebtedness, taxation, and revenues, it also contains digests of constitutional provisions on the same subjects. So far as available, acts of 1923 are included in the summary, together with all legislation up to the close of the calendar year 1922. It is interesting to note that 37 of the states now meet biennially (mostly in the odd numbered years), one quadrennially and only six states annually.

Unfortunately, the Bureau of the Census did not consider it practicable to do much in the way of tabular summaries. It stops short with summaries of inheritance tax laws, income tax laws and "poll taxes and fixed sums of money or limited amount of labor on public roads required of certain classes of persons." Further summaries that would have been welcomed by many, to name only two, are limitations on bonded indebtedness and taxation.

From a Foreword by Prof. Carl C. Plehn, of the Department of Economics of the University of California, it appears, among other things: (1) That the general property tax is "in operation practically everywhere in the United States," but has been modified with the aim of providing "new devices for reaching the tax paying ability represented by ownership of intangible property"; (2) that the poll tax is losing ground; (3) and (4) that inheritance and income taxes are spreading, the income tax now being in use "in nearly one-third of the states"; and that "taxing and spending districts organized for a single purpose, such as drainage, irrigation, and roads, have increased."

For the benefit of those who may be unaware of the fact, it may be stated that yearly summaries similar in general plan but more limited in scope than the one under notice are published in the semi-annual State and City Sections of the *Commercial and Financial Chronicle*, together with important details of the bonded indebtedness of the various states and cities of the country and editorial summaries of municipal bond sales by states, counties, etc., by interest rates and by purposes for the current year, with totals for the whole country by years from 1901 to the current date.

Water Treatment from a German Viewpoint

REVIEWED BY GEORGE W. FULLER
Consulting Engineer, New York City

TRINK UND BRAUCHWASSER—Von Prof. Dr. Hartwig Klut. Wiss. Mitglied der Preussischen Landesanstalt für Wasser-, Boden- und Lusthygiene, Berlin-Dahlem. Berlin and Vienna: Urban & Schwarzenberg. Paper; 6x9 in.; pp. 129; 11 line drawings. 3.6 gold marks in Germany.

The hygienic and chemical aspects of water supply are considered in this book with the purpose of showing concisely the main practical views relating to suitable water for drinking and industrial uses. The author has devoted himself largely to this subject since 1902 at the Prussian government station where city and district officials are instructed in hygienic matters. The scope of the book is comprehensive and it will serve as a ready, up-to-date reference book for medical and non-medical officials, as well as others who occasionally have to deal with the subject.

To water-works men the chief interest of the book lies in its presentation of the current German viewpoint on objectionable limits of various constituents of water and means for improvement. Filters are dealt with in 45 pp.; disinfection, 3 pp.; removal of iron and manganese, 8 pp.; softening by lime-soda and permutit, 12 pp.; and treatment of "aggressive" water (free carbonic and other acids), 6 pp. Discussion is given to corrosion, and action of water on various products with which it comes in contact. Methods of water examination are tersely stated in 25 pp. A German bibliography of the subject, apparently brought up to February, 1924, fills 7 pages.

Facts About Mining and Marketing Coal

THE COAL INDUSTRY—By A. T. Shurick. Boston: Little Brown & Co. Cloth; 6 x 9 in.; pp. 383; 56 line cuts and halftones; statistical tables. $3.50.

Although intended as an aid to the general public in obtaining a better understanding of the problems of the coal industry, engineers will find in this book much information of value to them because it is written by an engineer of experience in the field of coal mining. What he has gathered under one cover could not be obtained otherwise except by a painstaking search through the many books, periodicals, and documents dealing with the subject.

The four subdivisions of the book give a general idea of its scope: The Coal Fields; Mining Methods; Distribution of Coal; and Economic and Sociological Conditions. Subdivisions include information as to the coal reserves, early and modern methods of mining; markets and methods of marketing, cost of coal, company organization, and information concerning the miner and his unions. The statistical tables give figures on coal production and resources throughout the world and many details of the industry in this country, including also chemical analyses of the representative American coals.

Seasonal Construction and Unemployment

SEASONAL OPERATION IN THE CONSTRUCTION INDUSTRIES: The Facts and Remedies—Report and Recommendations of a Committee of the President's Conference on Unemployment, with a Foreword by Herbert Hoover. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 213; 20 charts; 34 tables. $2.50.

Inasmuch as this report was summarized in *Engineering News Record*, July 24, 1924, p. 144, little more than a listing of its contents is needed here. Primarily the work of the committee was directed to determine the extent and causes of seasonal unemployment in construction and to finding correctives. In general the first six chapters relate to the first task and consider effects of climate, weather records, and, in three principal chapters, the extent and nature of seasonal construction from the viewpoint of employment, dealers, contractors, architects and public utilities. In this portion of the report statistics abound and the tabulations are numerous. Altogether the volume affords perhaps the most complete available figures on seasonal variations, according to location and occupation, in employment.

The remaining eight chapters contain a technical discussion of possibilities and practice in winter construction. The chapter titles are: changes in the art of construction; practicability of continuous construction throughout the year; determining the remedies for seasonal construction; what groups within the construction industries have done; owners and seasonal construction; public works; roads; materials producers and transportation. The first two in particular of these chapters are excellent discussions of their subjects. Some of their notable features, and especially portions of the statistical sections, will be presented in a later issue of this Journal when co-ordinate facts can be considered and discussed.

There is much meat in this report for engineers and contractors. Gaps will be found in fundamental data and analysis is slurred over at times, but these faults can be overlooked in the gratuitous labor of a committee of busy men without time or means for original research.

Utility Valuation Simply Presented

THEORY AND PRACTICE OF PUBLIC UTILITY VALUATION—By W. H. Maltbie, Attorney at Law, Consultant on Public Utility, Valuation, Rates and Taxation. New York and London: McGraw-Hill Book Co. Cloth; 5 x 8 in.; pp. 201. $2.

Addressed to the "general public" rather than "the valuation expert" this book fulfills its purpose of presenting the principal points in the theory and practice of "public utility valuation." This is done without apparent bias to either side. The author first takes up original cost capitalization and market value of securities. He then devotes several chapters to cost of reproduction new, after which the discussion continues with overhead charges, intangible values and deductions from gross value. Depreciation has five chapters. The book closes with a consideration of present value and the rate of return.

The author's method of presentation is well suited to the general reader including the engineer who has not specialized in utility valuation. Specialists might find the book useful as a brief review of the main factors in utility valuation and perhaps get from it hints on presenting the subject to the "general public," as he may at almost any time have occasion to do.

PUBLICATIONS RECEIVED

IRRIGATION DISTRICT OPERATION AND FINANCE is an interesting review of 35 years' experience since the passage by the California Legislature in 1887 of the Wright Act authorizing the formation of irrigation districts. The review has been written by Wells A. Hutchins, assistant in irrigation economics, Division of Agricultural Engineering, Bureau of Public Works. (10c. from Superintendent of Documents, Washington, D. C.) During the period indicated 598 districts have been formed in 15 states. Two other states have passed enabling acts. Mr. Hutchins discusses the nature and present status of irrigation districts; reasons for success or failure, methods of formation, management, and finance; supervision and state financial aid, and also relations with the United States. The study extends to Dec. 31, 1921, only. At that time there were 241 districts in operation, 37 with works under construction, 159 in preliminary stages, and 158 inactive.

USEFUL INFORMATION under the title "General Data on the Activated Sludge Process of Sewage Treatment" has been brought together in a 47-p. pamphlet by the General Filtration Co., Inc., Rochester, N. Y., for free distribution. Besides general information on the activated-sludge process, there are descriptions of plants at Houston and Sherman, Tex., Milwaukee, Wis., Gastonia, N. C., abstracted from various sources, and a description of the North Side sewage-works of the Sanitary District of Chicago by Langdon Pearse, sanitary engineer of the district, which was apparently written especially for this pamphlet, and also a section on the fertilizing value of activated sludge. A valuable feature of the pamphlet is a 2-p. tabulation of comparative data on plant design and operation, based on information supplied for the pamphlet by engineers connected with the various plants listed. Design data are presented for Milwaukee, Indianapolis, and the Chicago North Side plant, and operation data for the Chicago-Calumet plant, the Houston-North Side plant, and the plants at Pasadena and Lodi, Calif., and Gastonia, N. C.

INFORMATION on the purpose, rules and activities of the American Engineering Standards Committee (29 W. 39th St., New York City) is given in the Year Book of the committee for 1924.

DRANG UND ZWANG, reviewed in our issue of June 19, p. 1068, is published by R. Oldenbourg, Munich, Germany. The name of the publisher was inadvertently omitted from our review. The price of the book, in Germany is 14 gold marks, unbound, and 15 gold marks, bound.

THE PORTLAND CEMENT ASSOCIATION has issued in pamphlet form a paper, Old and New Methods of Constructing Concrete Bridges, by J. B. Hunley, engineer of bridges of the Big Four Ry., which was presented at the Annual Convention of the American Concrete Institute last February. The paper is an excellent presentation of one of the modern methods of proportioning concrete which should be useful to all those who wish to put in application some of the latest theories of proportioning.

IN CONTINUATION of its economic and industrial survey the Committee on the Regional Plan of New York and Its Environs (130 E. 22d St., New York) has issued a bulletin on the Food Manufacturing Industries, prepared by Faith M. Williams, University Fellow in Economics, Columbia University (75c.). The general object of these monographs, of which there will be twelve in all, is to show the location and also the migration of various industries in relation to "the problem of planning the area." Various manufacturing plants in the region "are seeking cheaper sites." In 1917 there were five food plants on land valued at more than $5,000 per front foot; in 1922 there was one.

TWO PREVIOUS BULLETINS of the University of Illinois have reported the results of the elaborate investigation of fatigue of metals in progress there under the patronage of Engineering Foundation and a number of manufacturing corporations. These were bulletins 124 and 136, issued in 1921 and 1922 respectively. The present bulletin, covering the experimental work of 1923, considerably enlarges the

horizon of the field of fatigue and endurance. As in the work previously reported, most of the work here summarized relates to wrought ferrous metals, or various grades of rolled steel. A few tests on copper, brass and bronze, are included however. An article based on the present bulletin was published in *Engineering News-Record*, Aug. 7, 1924, p. 212.

THE UNIVERSITY OF WISCONSIN ENGINEERING Experiment Station (Madison) has issued a bulletin on Comparative Tests of New Billet Steel and Rerolled Steel Reinforcing Bars, by Jesse B. Kommers, associate professor of mechanics. It reports a rather extended series of tests of the strength of rerolled compared with new billet reinforcing bars and gives results not so favorable to the rerolled bars in some earlier tests. "The rerolled bar," says the report, "while of satisfactory strength must be considered very unreliable for work under conditions subjecting them to cold bending." An abstract of the conclusions deduced in the report appeared in *Engineering News-Record*, July 24, 1924, p. 146.

USERS OF LUMBER as well as dealers, associations and the lumber trade generally will be interested in Circular 296, Standard Grading Specifications for Yard Lumber, issued by the U. S. Department of Agriculture. The Central Committee on Lumber Standards, with its consulting committee, has evolved what has been endorsed by the lumber trade for a year's trial as American Lumber Standards for yard lumber. Official endorsement by the trade was secured in general conference held in Washington under the auspices of the Department of Commerce. This circular of 75 pp. and 22 plates is by Edward P. Ivory, associate wood technologist, David G. White, forest examiner, and Arthur T. Upson, in charge of the section of industrial investigations, all of the Forest Products Laboratory, Madison, Wis. (20c. from Superintendent of Documents, Washington, D. C.)

IN CONTINUATION of its pamphlet series, the British Portland Cement Association (6 Lloyds Ave., London, E. C. 3, England) has brought out researches on the theory of fine grinding, Part I., by Charles E. Blyth and others. Many tabular and other data are presented.

ACTIVATED-SLUDGE OPERATIONS at Houston, Tex., up to December, 1923, are reviewed by G. L. Fugate, principal assistant city engineer, in a 51-p. pamphlet, which is "more or less a summary of various annual reports, special magazine articles and papers before technical societies," according to Mr. Fugate's preface. Much of the earlier material has been presented or summarized in *Engineering News-Record*.

INFLUENCE OF HIGHWAYS ON RELIGIOUS LIFE is the subject of some fifty short essays selected from nearly 200,000 submitted by high school pupils in the 1923 university scholarship prize contest established by Harvey S. Firestone. (Highway Education Board, Washington, D. C.)

OILING EARTH ROADS is discussed in a practical and useful manner in a bulletin from the Engineering Experiment Station of the University of Illinois, Urbana, Ill. Both materials and methods are considered. The bulletin reports the conduct and results of a series of tests and observations extending through 1922 and 1923.

METHODS OF SAMPLING AND TESTING HIGHWAY MATERIALS as outlined in an exceptional report of the special committee of the Association of State Highway Officials are now presented in printed form by the Bureau of Roads, (Washington, D. C.). Bituminous, non-bituminous and metallic materials are covered in the report. There is also a section on testing culvert pipe.

TRACTIVE RESISTANCE ON ROADS, as determined by tests conducted by Iowa State College, Ames, Ia., in conjunction with the Bureau of Public Roads and the Iowa Highway Commission, is evaluated in a series of diagrams and tables recently published as Bulletin 67. These are perhaps the most complete resistance studies yet generally available to road engineers.

CONTRACTORS COST KEEPING, published by the Contractors Association of Northern California (San Francisco), contains cost codes and cost distribution lists which contractors will find useful.

A REPRINT from the Institution of Structural Engineer's *Journal* of January, 1923, has been made of the paper, "The Strength of Rectangular Slabs," by A. Ingersiev, of the firm of Peter Lind & Co., Reinforced Concrete Constructions, of London. The subject of the paper is the strength of rectangular slabs, limited to such slabs as have an appreciable thickness compared with the span, and more particularly limited to slabs of reinforced concrete. The solution of the problem is given by elementary calculus, based on the assumption that the bending moment in the breaking slab is distributed along the 45 deg. lines from each corner. On this assumption the fairly simple formulas are worked out and a comparison given between the formulas so worked out and the various formulas in use over the world.

THE SECOND YEAR'S STUDIES on The Biology of Sewage Disposal conducted jointly by the New Jersey Agricultural Experiment Stations and the New Jersey State Department of Health (New Brunswick, N. J.) are reported in a 78-page bulletin. The studies are brought down to June 30, 1923. The leading paper, by F. L. Campbell and Willem Rudolfs, the latter being the director of the station, deals with Chemical Studies on the Joint Sewage Disposal Plants of Plainfield, North Plainfield and Dunellen. Other papers take up fauna, fungi and algae of sprinkling filters, bacterial studies of Imhoff tanks and sprinkling filters and experiments on the use of aluminum sulphate to hasten the air drying of sludge on beds.

A CITY PLAN for Springfield, Mass., makes up the bulk of the 1923 report of the planning board of that city. The report is handsomely illustrated with halftones and there are also maps and reports in a supplementary envelope. The Technical Advisory Corporation of New York City are consulting engineers and Frederick L. Olmsted, Brookline, Mass., is special adviser to the board.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

THE CALCULUS FOR ENGINEERS—By Ewart S. Andrews, B.Sc. Eng. (London), Author of "Theory and Design of Structures," Fellow of the Chartered Institute of Patent Agents, formerly Demonstrator and Lecturer in the Engineering Department of University College, London; and H. Bryon Heywood, D.Sc. (Paris), B.Sc. (London). Second Revised Edition. [The Broadway Engineering Handbooks; Vol. XIII.] London: Scott, Greenwood & Son. Cloth; 5 x 8 in.; pp. 269; 102 line cuts; 28 pp. mathematical tables. 7½s. in England; $3 in United States.

The first edition was reviewed by Lewis E. Moore in *Engineering News*, Jan. 21, 1915, who stated that the book's chief claim for being an engineering presentation of the subject was that the examples were chosen from engineering subjects. The extent of the present revision is not indicated.

MARINE STRUCTURES: THEIR DETERIORATION AND PRESERVATION, Report of the Committee on Marine Piling Investigations of the Division of Engineering and Industrial Research of the National Research Council—By William G. Atwood and A. A. Johnson; with the collaboration of William F. Clapp, of Robert C. Miller, of the University of California, and of H. W. Walker, H. S. McQuaid and Marjorie S. Allen of the Chemical Warfare Service, U. S. A., Washington, D. C.: National Research Council. Cloth; 6 x 9 in.; pp. 534; 168 halftones, line drawings, charts and maps; bibliography.

THE MODERN EXECUTIVE—Compiled and Edited by Daniel Bloomfield, Director, Retail Board, Boston Chamber of Commerce; Author of "Labor Maintenance," etc. Introduction by Meyer Bloomfield. [The Modern Executive's Library.] New York: The H. W. Wilson Co. Cloth; 5 x 8 in.; pp. 266. $2.25.

A compilation of papers and addresses grouped under Leadership, Place of Executive in Management, Developing Executive Ability, etc. There is a bibliography.

PONTS EN MAÇONNERIE—Par C. Gay, Ingénieur de la Cie. des Chemins de Fer P.-L.-M. Avec le patronage de la Société d'Encouragement pour l'Industrie Nationale et de la Société des Ingénieurs civils de France. [Encyclopédie du Génie Civil et des Travaux Publics. Publiée sous la direction de M. Mesnager.] Paris: J.-B. Bailliere et Fils. Paper; 6 x 9 in.; pp. 704; 522 line cuts and halftones; two insert plates. 60 fr. in Paris.

THE REPARATION PLAN: An Interpretation of the Reports of the Expert Committees Appointed by the Reparation Commission, Nov. 30, 1923—By Harold G. Moulton, with the aid of the Council and Staff of the Institute of Economics. [Institute of Economics Series.] New York and London: McGraw-Hill Book Co., Inc. Cloth; 5 x 8 in.; pp. 325. $2.50.

THEORIE UND BERECHNUNG DER EISERNEN BRÜCKEN—Von Dr.-Ing. Friedrich Bleich. Berlin: Julius Springer. Cloth; 8 x 11 in.; pp. 581; 486 figures in the text.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Why a Neat Cement Test?

Sir—The article by Thaddeus Merriman in your issue of July 17, p. 105, on "Some Requirements in the Study of Portland Cement" is of much interest as an expression of the need felt by users of that material for further study of its properties, and of the scope which such investigation should have.

With reference to his discussion of neat cement tests, however, the question arises, since in actual service its strength comes into play as a binder between the particles of aggregate with which it is used—Is not a strength test which covers this feature the most direct measure of its serviceability? Does a neat tensile test develop the "inherent" strength of the cement? On the contrary, has not the increased strength in sand-mortar tests which has followed improvement in fineness of grinding been co-existent with a general reduction in strength of neat tests? Is not the latter a measure of the strength developed by the particles in that particular form of combination, rather than of the potential strength inherent in the material?

As illustrating this (though not with portland cement) an interesting item in the writer's early experience was the discovery that one of the natural cements of the Lehigh Valley district, on which the fineness of grinding was a marked feature, gave on long-time tests, beginning with the three-month period, higher results in a 1:1 mortar than in neat; and beginning with the one-year period, results in 1:2 mortar were practically equal to those in neat. The neat tests, in themselves, showed a steady increase from period to period, and did not retrogress.

The retrogression often observed in neat tests of portland cement, before these were dropped from the standard specifications, was usually accompanied by a normal increase on mortar tests. A table which brings this out was prepared by the writer from records of the laboratory of the U. S. Reclamation Service, of which he was then in charge, for use of the joint conference of 1912-15, which evolved the present specification. Summary of this table shows that on 28 sets of tests of 5 briquets each the respective neat results at 7- and 28-day periods averaged 766 and 719 lb. per sq.in., or a decrease of 6.1 per cent. The corresponding 1:3 sand tests averaged 331 and 418 lb. per sq.in., or an increase of 26.3 per cent.

The main virtue in the use of blended cements, of which the sand cements used by the Reclamation Service on some of its large dams are a type, lies in the proposition that the regrinding process through which they are passed does develop and make available strength properties of the cement not brought out in the ordinary process of manufacture. A neat test on this product would not show very much, but the standard mortar test does show that it has sufficient strength for use in mass concrete in a dam of gravity section.

While neat tests doubtless should be included in a research study of cement, it seems to the writer that they are not of enough service to warrant restoration as an acceptance test.

J. Y. JEWETT,
Testing Engineer, City of San Diego.

San Diego, Calif.,
Aug. 8, 1924.

Better Cement and Better Concrete

Sir—Interest in the article by Thaddeus Merriman (July 17, page 105) is widespread among all users of concrete. A responsive chord is struck in proposing that some means be found by which better concrete may be more uniformly had than is had at the present time. There is no problem more important in the construction field. But in getting at the means for securing this better concrete, it is pertinent and proper to inquire if some of the premises on which Mr. Merriman's conclusions rest are correct; and if the remedies suggested will be adequate to this end.

Briefing Mr. Merriman's article for purposes of study, it is found difficult to reconcile some of those premises one with another. For instance, it does not seem warranted to hold that investigation has reached an impasse such that we must, to the exclusion of all else, make search for a better cement, so long as concurrence is had with Mr. Merriman's belief that physical strength tests in tension and compression are unavailing and uninformative, and that research endeavors in the past have been largely confined to such tests in limited service, and with restricted observation.

It is a pleasure to note recognition by Mr. Merriman and by his important office that compressive or tensile strength tests alone have very little, if anything, to offer as to why some concretes endure and others do not endure in one or another of perhaps a thousand different conditions of service and exposure. Such recognition is of the utmost importance, for it carries with it recognition of permanence as of equal value with primary-stage strength, as well as of affecting substances and of affecting conditions which may alter the value of any concrete, independent of the absolute strength-producing value of the cement used therein.

It is a pleasure also to agree that any and all investigation which will tend to improve cement *per se* is desirable; but at the same time it is an obligation on the engineering fraternity to state the whole case carefully before judgment is rendered; and to weigh carefully and logically all facts pertaining to the behavior of concretes and the responsibility of cement for behavior that may not meet anticipations.

Lest we fall into error, it may be well to state the case for cement as it is.

Let us recognize as a basic fact that in the manufacture of cement a huge-scale complicated process in chemical engineering is painstakingly being carried out; and this to the comfort, the advancement and the security of our civilization and the well-being of those that dwell therein. Let us also recognize that many of the thousands who daily use a part of this cement in construction have no more than an elementary conception of the abilities and disabilities of concrete, or of how to use cement in concrete. And watching the operations of such men, it seems incumbent upon us to recognize further that portland cement, by and large, is the best-natured, most patiently-uncomplaining and most abused structural medium to which we have recourse in our vast construction programs, whatever may be its absolute quality or its lack of uniformity.

"Poor" cement is unquestionably made and unquestionably sent cheerfully on its way to the market. "Good" and possibly perfect cement also is made and devoted to public use. No brief is held for or against the gentlemen in the cement industry; but we must recognize that it is very far from being proven beyond question that these men are solely responsible for disintegrations of concrete because of the product they market. That they should progress both in knowledge and in the commercial applications of such knowledge is granted, but it might also be granted in fairness that the user should advance a like distance in his provinces.

It must be further recognized that "poor" cement and "good" cement are definable at the present time only in terms of passing or failing to pass in rather crude tests a specification that is somewhat deficient as a determinator of absolute values. And to get a new and better definition of absolute values, costly research is needed, for this definition must be both evolved and proven, possibly through the development of new tests and of new apparatus for tests, and certainly through the acquiring of a new, more logical and more thoughtful viewpoint. Only when this is accomplished can we have a better and more determinative specification.

This means, therefore, that time must elapse before a change will be inaugurated—time for research, time for general education and time conceded to conservation. By all means, let the research be started.

But while this research is going on, it must be recognized that all cement that can be made in these interven-

ing years will be demanded by the public; that it will be mixed with earth-dug materials and with water, even as in the past. And this great output of cement, as a seven-times volume of "mud," will go into a vast number of "boxes"; it will there solidify; and so far as physical strength alone is concerned will do its allotted work in the great majority of instances. Some of it, also, will not do its work after the passage of a greater or less period of time, with some of this defective work done by a "Grade A" contractor and some of the enduring work done by a "Grade Z" contractor and *vice versa*, each using the same cement.

It is therefore quite certain that engineering and commerce will not wait supinely for this research on cement. Too much value is at stake and too much pride—and it is already recognized that something outside of and aside from cement is entering into these "failures." This recognition has already produced results of value, both in repairing old work and as a guide in new work.

For these "failures" are no longer an insoluble mystery. An expert study of them is without parallel in its informative value. Much remains to be done, but information is already at hand that enables causes of trouble to be accurately determined, that in many cases enables deterioration to be arrested before it reaches a serious point, and that in some cases enables a restoration to strength to be brought about *in situ*.

The foundation stone of such knowledge is "the mystery of what occurs in setting," which it is believed Mr. Merriman feels "has never been solved." This setting process has, on the contrary, even been made visible; and as a corollary to this, these substances which arrest or retrograde such processes (which is the mechanism and the very essence of failures and disintegrations) have been studied, classified fairly well and the specific action of each made recognizable.

There is, therefore, a definite poisoning of concretes associated with failures; and the substances which so poison concrete are known as well as their antidotes.

Tannic acid as such a poison has long been known, but it is a feeble and easily neutralized poison compared to others; and many if not all of these poisons come from the earth-dug substances which are added to cement to make concrete. No matter, then, how perfect or how poor the cement used, if these poisoning substances are present the result will be unsatisfactory to a degree dependent upon the virulence of the poisons and upon their quantity presence.

Permanence in concretes further depends on a variety of other factors, such as the relation of size of ballast to section of forms; the lubricative value of the ballast *per se;* the character of form surfaces; prevailing temperatures; average humidity; cleanness of sand and ballast; the chemical nature of sand and ballast; and, not least, upon the obtaining of definite quantities of sand and ballast per batch and in each batch as against the variable quantities that prevail wherever bulk measurement is used.

All of the foregoing, except the chemical or mineralogical composition of sand and ballast, are physical alteratives, which undeniably affect concrete. It is beside the point to say that concrete is affected by affecting the cement, for it is doubtful if any cement could be long-suffering enough to stand without retaliation all the indignities commonly heaped upon it.

There are also conditions of exposure in service that must be considered. It is not gilding the lily to say that in some conditions cement never has a chance to make good. In a recent work, disintegration by acid was directly invited by slapping a 5-in. slab, without waterproofing, directly on 6 to 8 in. of poor cinders over a perpetually-wet hillside. With a bounteous supply of acids evolved on one side and evaporation on the other, there seems but one result to be anticipated, within a relatively short space of time.

Getting concrete in place cheaply and quickly is, at the present time, the most desired goal. The executive demands it, the foreman demands it, the laborer meets the demand—and the owner acquiesces. Again and again cement is given only the proverbial Chinaman's chance.

Yet, this commercial demand for speed and cheapness is necessary and right. In fact, costs are too high today and may be cheapened within reason, with, at the same time, a better product. The abilities of even present-day cements are so wonderful and the untouched reserves of strength so great in all concretes that, if these are but called to action, a much improved result is obtained.

It would seem, therefore, since conditions of use and of service, as well as substances other than cement, affect both quality and endurance in concretes; since a perfect cement will be some time in reaching technical acceptance and the market; since the cement manufacturers are, in the main, striving to better their product, with particular emphasis upon composition, raw grinding, blending and burning; and since the present product is not without its merits; that the program of present needs as outlined by Mr. Merriman might be revised as follows:

1. A cement of uniform and standard chemical composition, through careful selection, grinding and blending on the raw side.

2. A cement subjected to a better-controlled burning.

3. A cement less sensitive to water after hydration in concrete, if such a thing be possible with a substance so largely colloidal.

4. A better understanding of cement and of concrete by users; and a recognition of this understanding (a) in design; (b) in properly planning the use and exposure with protective measures when necessary; (c) in specifications that shall embody essentials only and that shall be a help, rather than an aggravation to the field; (d) in a better executive viewpoint, which will recognize that the making and use of concrete is something more than a problem in buying or in labor administration; (e) in better machinery for measuring sand and ballast, preferably by weight; (f) in better mixing machinery, which shall contribute to better handling by the thoroughness of mixing, and by the plastic consistency attained in any allowable time interval, and that shall further contribute to both permanence and strength by bringing into action at least a part of the unused reserves of cement; (g) in a better knowledge of materials, so that poisonous substances or inimical aggregates may not be used; (h) in better superintendence, so that "inspection" shall not, in effect and in substance, comprise the counting of cement sacks or the tallying of men; and (k) in the use of foremen and laborers according to their proper abilities, rather than by economic pressure compelling them to act as experts with supreme authority, in virtual supersedence of the engineer.

5. A more intelligent use of some present-day tests and the elimination of others.

6. A recognition that repeated doing of ineffective and wrong things, year after year, is not conservatism, but destructive and wasteful radicalism.

There is, therefore, a case for as well as against present-day cement.

And it is ventured that even though there were perfect cement being distributed today in place of that which we now have, some constructions would prove disappointing, so long as present habits of thought in the office and on the job and present field procedures remain as they are.

New York, Aug. 14. NATHAN C. JOHNSON.

Record Shows Many Careless Drivers

Careful records of all accidents at Baltimore & Ohio R.R. grade crossings in the city of Baltimore show that in twenty-four instances during the last 6 months crossing gates which had been lowered before the arrival of trains were run into by motor vehicles and broken. Some of the accidents were due to bad brakes on the motor cars, others to speeding and trying to stop suddenly on slippery streets. In several cases drivers deliberately drove their cars into the gates. Two horse-drawn vehicles plunged into the crossing gates. One automobile ran into the side of a train moving over the crossing and two motor trucks stalled on the tracks and were struck. Of the thirty accidents, sixteen occurred at night and fourteen in daytime. In one case, outside of the city of Baltimore, a crossing watchman standing in the center of the crossing with his stop disk raised was struck by an automobile and killed.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Am. Soc. C. E. Passes Resolutions Regretting Loss of Secretary

At its meeting on Aug. 1, the executive committee of the American Society of Civil Engineers passed the following resolutions:

Whereas, it has pleased Almighty God to take from us our beloved Secretary, John Hoffman Dunlap;

Be It Resolved: That the president and the executive committee, in behalf of the Board of Direction and the members of the American Society of Civil Engineers, express their sense of the great loss which the society and the engineering profession of the United States have suffered by the death of our secretary, who, by his labors in our behalf, by his faithfulness, efficiency and courtesy, by his advocacy of the highest ideals for the advancement of the profession, by his unselfish efforts to serve every member of the society, and by the example he set us as a Christian citizen, has made a lasting impression in our hearts;

Be It Further Resolved: That our heartfelt sympathy be extended to his family, that his family be furnished with a copy of this resolution, and that it be spread upon our records, printed in the "Proceedings" and "Transactions," and that copies be furnished to the technical press and to other engineering societies.

Mr. Dunlap died July 29 from injuries received in a train wreck near Buda, Ill., June 30.

Pennsylvania R.R. Puts More Trucks Into Service

The extent to which motor trucks are being used for less-than-carload-lot freight on the Pennsylvania R.R. system is indicated by the number of routes over which the company no longer operates its old l.c.l. service. The state of New Jersey is now completely motorized in so far as the handling of l.c.l. freight by trucks to replace l.c.l. freight trains on the Pennsylvania system is concerned.

Among the routes on which trucks have been put in the l.c.l. service on the Pennsylvania lines, exclusive of the trucks recently put in service on the north shore of Long Island by the Long Island Railroad Co., a subsidiary of the Pennsylvania, are the following:

	Miles
Trenton to Lambertville, Trenton Division	16
Trenton to Linden, New York Division	49
Uniontown to Ruffsdale, Monongahela Division	38
Toms River to Sea Girt, Trenton Division	23
Sea Girt to South Amboy, N.Y. & L.B.R.R.	33
Sea Girt to Jamesburg, Trenton Division	28
Walnut St., Phila., to Trenton via Pemberton inc. Mt. Holly, Browns Mills and Upton, etc., Trenton Division	78
Enon to Alliance, Eastern Division	53
Trenton to Phillipsburg, Trenton Division	51

Information Being Sought on American Ports

In accordance with a decision reached at a meeting of the executive committee of the American Association of Port Authorities in New York last year, questionnaires have been circulated among all the principal American ports with the idea of securing accurate information on all American ports. The president of the association has appointed a committee, consisting of E. F. Nicholson of Seattle, Wash., chairman, Brig.-Gen. T. L. Tremblay of Toronto, Canada; and C. T. Leeds, consulting engineer of Los Angeles, to prepare the data for general circulation.

The committee has drawn up a questionnaire which it believes covers all the important matters pertaining to port construction and operation. After the questionnaires are answered and returned, it is intended to compile the information in tabulated form and print it as a pamphlet for distribution to port officials in Canada and the United States.

Among the principal items of information sought are the following: Organization of port administration, organization of staff, system of operation, ownership of waterfront, berthage capacity, storage facilities, type of wharves, type of transit shed, type of warehouse, mechanical freight-handling equipment, rail terminal facilities, roadways and highways, auxiliary waterways, oil-handling facilities, import and export tonnage, traffic movements in ports including ship, rail and vehicular, port charges, dockage, pilotage, towage, lighterage, switching, cartage, stevedoring, financial, traffic promotion, advertising, industrial sites, and oil refuse in harbor.

Surveys for Grand Falls Power Projects Being Made

Complete detail surveys of the possible storage reservoirs and dam sites on the St. Johns River looking toward the construction of a hydro-electric plant at Grand Falls, New Brunswick, Can., are now being made. As the St. Johns River is largely international in character, the project must have the approval of the International Waterways Commission before any actual construction on the project can be installed.

The studies are being carried out under the direction of the New Brunswick Electric Power Commission. The initial plans call for the development of 40,000 hp. on the Canadian side of the Falls and an ultimate development of 120,000 hp. provided satisfactory arrangements can be made for the storage of water in the upper part of the watershed of the river in Maine.

Ridgway Nominated To Head Am. Soc. C. E.

Humphrey and Ketchum are Official Nominees for Vice-President—Total Vote Cast 4,330

Robert Ridgway was chosen as official nominee for president of the American Society of Civil Engineers when the second canvass of ballots for nominees was taken Aug. 15. His vote totaled 3,188 out of 4,330 votes cast, Leonard Metcalf receiving 1,079 votes. Richard L. Humphrey and Milo S. Ketchum were selected as nominees for vice-president from Zones 2 and 3, respectively. The result of the ballot follows:

For President: Robert Ridgway, 3,188; Leonard Metcalf, 1,079.

For Vice-President, Zone 2: Richard L. Humphrey, 508; John C. Hoyt, 393; John E. Greiner, 255.

For Vice-President, Zone 3: M. S. Ketchum, 447; H. R. Safford, 292; Willard Beahan, 186.

For Directors, District 1: W. T. Chevalier, 694; Charles Gilman, 534; James F. Sanborn, 448.

For Director, District 2: C. M. Spofford, 201; C. M. Saville, 115.

For Director, District 6: A. R. Raymer, 102; E. K. Morse, 40; C. P. Fortney, 27.

For Director, District 10: P. H. Norcross, 174; G. M. Braune, 113.

For Director, District 13: H. D. Dewell, 188; C. H. Sweetser, 45.

Heavy Vote for Trunk Sewer Bonds at Kansas City, Mo.

Two large bond issues for trunk sewers and one issue to change the plan of financing a trunk sewer already built carried by a vote of nearly 7 to 1 at Kansas City, Mo., on Aug. 8. The total vote on each issue was over 50,000. Of the $8,500,000 voted $3,000,000 is for the Blue Valley sewer, $2,500,000 for the Goose Neck sewer and $3,500,000 to place the cost of the Turkey Creek sewer on the city as a whole instead of upon owners of real estate in the sewer district.

Prior to enactment of recent constitutional amendments the cost of trunk sewers was raised by assessments on a single uniform basis determined by dividing the total cost by the number of square feet in the assessment district. It was alleged in favor of the change in plan just authorized that the old plan sometimes burdened the owner of a small house and lot with an assessment up to half the taxed value of the lot while business property on a percentage basis was allowed to go almost free.

Marseilles Power Suit Settled Out of Court

Surplus Power to Be Paid for on Electrical Output—Litigation Covered Ten Years

After ten years of litigation over the method of paying for surplus power, the suit of the Marseilles Land and Water Power Co. (of Marseilles, Ill.) vs. the Northern Illinois Light and Traction Co. has been settled out of court, the basis of payment for power agreed upon being electrical output rather than hydraulic measurements. The case involved one of the most extensive pieces of water power litigation in the history of American law. More than 40,000 pages of testimony were taken and 10,000 additional pages were offered as exhibits.

The Marseilles Land and Water Power Co. was granted rights by the Illinois State Legislature in 1867 to construct a dam across the Illinois River at Marseilles and to build raceways. The dam and raceways were built but the power company did not undertake to develop any power itself, merely leasing water for the development of about 10,000 hp. to its tenants. Previous to 1900 the flow in the Illinois River was very irregular and the power project was not a success, but since that time the water from the Chicago Sanitary District Canal has made it quite uniform and conditions have improved. In 1910 the Northern Illinois Light and Traction Co., the largest tenants of the water power company, bought all the fixed leases outstanding which had either been forfeited or surrendered during the period preceding 1900. These fixed leases guaranteed the delivery of a fixed amount of water horsepower and at the time of their purchase the water power company and the traction company entered into another contract designated the "surplus lease" under which the traction company undertook to take and pay for all the continuous horsepower over and above all fixed leases outstanding. This lease also contained the provision that the traction company would have the right to use, free of charge, all water in the river over the continuous power contracted for under the surplus lease and also all water contracted for but not used by other tenants.

The 1910 surplus lease was hurriedly executed as the option time had about expired, and the principal owner of the water power company was sailing for Europe. In this way a paragraph from one of the fixed leases was inadvertently incorporated in the surplus lease. This paragraph referred to payment on the basis of the electrical output, and also contained provisions as to certain plant efficiencies.

The plaintiff contended that this paragraph did not apply inasmuch as the surplus lease contained a provision that made the defendant pay whether the power was used or not. Available surplus continuous power not used would not be shown on the plant meters. The defendant also took the position that the electrical method was not intended and did not apply because it was impossible to differentiate between the pay kilowatt hours and the free kilowatt hours arising from the power contracted for by other tenants and not used by them, and also from the secondary power.

This contract also provided that the surplus power was to be paid for on the basis of the continuous power over the fixed leases on the four lowest days of the year. The intent of the contract, and this was followed out by both parties in their proof, was that payment should be based on hydraulic methods rather than electrical methods. No attempt was made by plaintiff to break the contract on account of the dual pay provisions.

As the litigation centered around the method of paying for the power, which, on account of the way in which the contract was drawn was complicated by the peculiarities of the flow of the river, it resulted in elaborate studies of the flow of the river by a staff of engineers. W. S. Richmond was the chief hydraulic engineer for the water power company, and the following engineers acted in a consulting capacity at various times for this side: F. C. Shenehon, Isham Randolph, T. W. Orbison, G. J. Lyon, R. E. Horton. For the defendant J. P. Alvey was the chief hydraulic engineer, and the following engineers were the consultants: C. W. Humphrey, R. S. Kelch, L. E. Cooley, Gardner S. Williams, J. A. Walls, L. E. Moody and B. F. Groat.

Radical Changes in Water-Works Plans for Kansas City

Radical changes in the Fuller & Maitland water-works improvements plans for Kansas City, Mo., which it is said will provide for an early supply of 100 m.g.d. of filtered instead of 40 m.g.d. of unfiltered water within the $11,000,000 bond authorization, have been effected under the new city administration through the agency of a board of four local engineers appointed by Mayor Beach and with the cooperation of Fuller & Maitland. The latter will continue as engineers for the improvements, but on a compensation basis different from the 9½ per cent commission for engineering work and supervision provided for in their contract with the Cromwell administration.

The plans first recommended by Fuller & Maitland would have provided 120 m.g.d. of filtered water at an estimated cost of $20,000,000 but to keep within the $11,000,000 thus far available some of the proposed work on the 120-m.g.d. project was postponed, including filtration and a large part of the proposed increase in quantity. Some of the changes adopted to get 100 m.g.d. of filtered water in place of 40 m.g.d. of unfiltered water are location of some of the plant on bottom lands instead of at a higher elevation, decrease in settling basin and pump capacity and elimination of some of the pipe cross connections just outside the pumping station.

The members of the board of local engineers, named June 26, are Louis R. Ash, Wynkoop Kiersted, R. E. McDonnell and N. T. Veatch.

Southern California Edison Rate Case Reopened

Hearing Called for Aug. 13—Dissenting Opinion Leads to Reconsideration of Increase

Less than a week after granting the Southern California Edison Co. an emergency rate increase of 10 per cent, the California Railroad Commission issued an order re-opening the case and calling a hearing for Aug. 13 in Los Angeles. The 10 per cent increase applied to all schedules except agricultural rates, effective Sept. 1, for a period of eight months, and was granted to the company because of the abnormal expense to which it has been put in generating steam power and purchasing energy from other utilities to meet the shortage of hydro-electric power in Southern California. (See *Engineering News-Record*, June 26, p. 1115.)

Basis of Re-opening of Case

The re-opening of the case comes as the result of a dissenting opinion filed by Commissioners Clyde L. Seavey and Egerton Shore. They base their opinion on five points, namely:

The principle of basing rates upon average conditions over a period of years rather than upon special conditions of any particular year.

The unsoundness of granting emergency rates in the face of the company's present ability to pay 8 per cent dividends on its common stock.

The injustice of imposing upon the company's consumers, the cities, industries and other public utilities dependent upon this company for their electric light and power, of the extra burden of sharing the company's temporary losses in addition to the hardships and losses which they themselves are enduring from the same causes.

The incompleteness of the record in the proceeding, which did not include any report of check made by the Commission's engineers.

The failure of the majority decision to take into account the accumulated surplus of the company, which, according to the dissenting Commissioners' opinion, together with the contingency reserve and the estimated net revenue for the year, enable the company to meet all operating expenses, depreciation annuity, interest on bonds and all dividends on stock, including 8 per cent on its common stock, and still leave a modest surplus.

Dissenting Opinion

The dissenting commissioners held that if any conservation is required it should be made by reduction of the common stock dividend rather than by any temporary increase of rates.

The company claimed that because of the existing abnormal power costs it would suffer a loss of about $5,600,000 in its net revenue under present rates and asked the commission for an increase in rates to produce additional revenue amounting to $3,000,000. The commission, however, did not allow this claim in granting the 10 per cent increase but made an order cutting the company's demand to an increase estimated to yield revenues of approximately $1,100,000.

Condition of Reclamation Projects Promising

Dr. Mead Reports Complete Development of Existing Projects Necessary After Trip Through West

Washington Correspondence

Following a two months' trip during which he visited thirteen of the Federal reclamation projects and six of the proposed projects, Dr. Elwood Mead, the new Commissioner of Reclamation, has returned to Washington convinced that the next step in reclamation should be to complete the development of existing projects. In many of these a partial development was made at the outset and completion left until sufficient progress in settlement had been made to warrant the completion of the works. On many of the projects Dr. Mead believes that this time has now arrived and that not only should provision for water supply be made but that whatever legal proceedings are needed to define and establish water rights and settle the obligations of the settlers to the Government should be inaugurated and a final settlement secured. When the Government has complied with those obligations and has established the fundamental agricultural and economic facts necessary to the successful conduct of these enterprises, Dr. Mead feels that settlers will desire to show what they can accomplish if left free to carry on these projects.

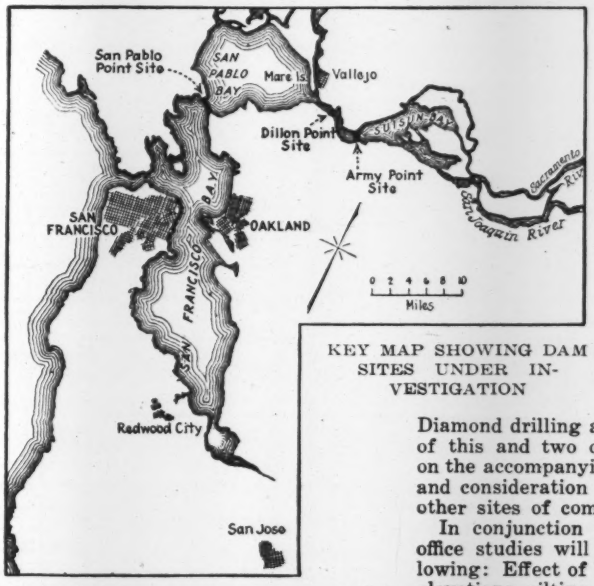
Lake Tahoe Situation

Dr. Mead was much pleased with the friendly attitude of the riparian owners on Lake Tahoe, who agreed readily to the use of water from the lake to relieve a serious situation on a portion of the Newlands project. They were concerned only in securing assurances that this action would constitute no precedent. A precedent in the use of water has unusual importance under the California law.

By pumping this water into the Truckee River no crop damage will result on the upper end of the river where additional water was required to meet a dearth which was fast developing. Below there was one limited area in which some damage resulted before the additional water could be secured, but the supply from the lake will protect their trees and will permit the production of a fall crop of alfalfa. The diversion necessary is expected to lower the lake level only two or three inches. The agreement provides that the lake level is to be lowered no more than six inches in any event.

Unusual grit and resource have been displayed by the settlers on the Okanogan project, Dr. Mead states. The project always has been short of water supply. To meet the unusual situation of this year the settlers bought out some of the old rights on the stream in order to get more water. In addition they bought the winter flow of Johnson Creek which they diverted into Duck Lake. Finally Duck Lake was lowered to the point where it was necessary to raise the water 50 ft. Then the pressure of ground water became so great as to cause the banks to begin to slough off. This made it very difficult to maintain the positions for the pumps, but all these difficulties were met and overcome. In addition two miles of ditches and a power line were run to Green Lake, so as to permit pumping operations there. On a part of the project underground water supply was available and many settlers put down wells on their own land. It even was necessary to install a pumping plant in the reservoir so as to utilize the content below the outlet. Despite all these efforts some one thousand acres of the orchards would be short of water. Dr. Mead cites this as an example of what co-operation can accomplish.

The drought, Dr. Mead points out, is confined to the region west of the Rocky Mountains. In the mountain region the season has been unusually propitious. Montana, Wyoming and Colorado have had fine crops which are bringing good prices. Farmers in these states are enjoying one of their most prosperous years. Even west of the mountains the losses have not been complete or universal, Dr. Mead states. On the Yakima project no losses were suffered. There has been no scarcity of water on the Klamath, while the losses in Idaho have been only partial. The early crops had sufficient water. Speaking generally the spirit among the settlers is at a high point. With the exception of two or three projects Dr. Mead thinks all should be able to meet their payments this year.



KEY MAP SHOWING DAM SITES UNDER INVESTIGATION

New York Man Heads Pan-American Railway Committee

Charles M. Pepper of New York City has been named chairman of the Pan-American Railway Committee of the Pan-American Union. The appointment of the committee was announced in *News-Record* July 31, 1924, p. 197. The other two representatives of the United States are Verne L. Havens and Minor C. Keith. Tobias Moscoso of Brazil is vice-chairman.

Dam Proposed to Decrease Salinity of Sacramento

Surveys Being Made in Suisun Bay Under Supervision of U. S. Reclamation Bureau

The admixture of the salty waters of Suisun Bay, an arm of San Francisco Bay, with the inflowing waters of the Sacramento River has so increased the salinity of that river at times as to interfere with the use of the river water for domestic and irrigation purposes. In hope of finding a solution of this difficulty a survey and investigation is being made to "determine the feasibility and probable cost" of a dam to exclude sea water which would be built across one of the narrows in the bays below the mouth of the Sacramento River. The work is under the supervision of the U. S. Bureau of Reclamation in co-operation with the California State Department of Engineering. Walker R. Young, assistant engineer, U. S. Bureau of Reclamation, is in charge and W. A. Perkins, of the California Department of Engineering, is assistant. Funds for the survey were contributed by the Sacramento Development Association, the state of California and the U. S. Bureau of Reclamation. Reference to the increased salinity of the waters of the lower Sacramento River appeared in *Engineering News-Record*, Sept. 23, 1920, p. 611.

Under the plan adopted at a recent meeting of representatives of the three interests mentioned, the survey was started at the so-called Army Point site at the lower end of Suisan Bay. Diamond drilling and other field studies of this and two other sites, as shown on the accompanying map, will be made and consideration may also be given to other sites of comparable importance.

In conjunction with the field work, office studies will be made of the following: Effect of barrier on flood-plane elevation; silting of Suisun and San Pablo bays; tidal prism of San Francisco Bay, and navigation; design of barrier; design of locks and gates for navigation and passage of flood water. One of the most important considerations is the effect of such a dam on the flood-water levels in the lower reaches of the Sacramento river.

In this connection fully $35,000,000 have been expended by California, the Federal Government and landowners on the flood control project of the Sacramento River since 1909, according to a report compiled by A. M. Barton, chief engineer of the California State Reclamation Board.

As advisors in the matter the state of California has called in the following engineers: W. L. Huber, B. A. Etcheverry, A. J. Cleary, G. A. Elliott, F. C. Herrman and A. Kempkey.

Fifty-Five Mile Cutoff on Ford Railroad Authorized

The Detroit & Ironton Railroad Co. has been authorized by the Interstate Commerce Commission to construct a double-track railway extending from a connection with the Detroit, Toledo & Ironton R.R. at Malinta, Henry County, Ohio, in a northerly and northeasterly direction through Henry and Fulton Counties, Ohio, and Lenawee and Monroe Counties in Michigan, to a connection with the D., T. & I. at Durban, Monroe County, Mich., a distance of approximately 55.7 miles. In its application the Detroit & Ironton states that the distance between Malinta and Durban via the existing line of the D., T. & I. is 76.2 miles, so that the saving in distance by the new line will be over 20 miles. With the improvements in grade to be obtained by the new line, it is estimated, on the basis of 1923 traffic, that the proposed cutoff will save $203,000 a year in operating expenses not including the saving of rental for trackage rights between Tecumseh and Dundee, Mich. At the present time the D., T. & I. has trackage rights over the New York Central tracks between Tecumseh and Dundee, a distance of 15.6 miles, for which it paid $90,945 for rental, maintenance and operation.

On account of the bad grades and sharp curves, the D., T. & I. is unable to handle all the business that is offered, including in 1923 about 16,000 cars of high-class commodities from the Ford Motor Co.

The new line will be double tracked and laid with 90- or 100-lb. rails. The applicant proposes to commence construction as soon as the right-of-way is acquired and expects to complete the line within three years. The estimated cost of acquiring right-of-way and construction is $8,350,000. The application shows Henry Ford as president of the railroad.

Railroad Project Authorized in Washington State

The Wenatchee Railway Co. has been authorized by the Interstate Commerce Commission to construct a standard gage railway line extending from Wenatchee through Chelan, Kittitas, and Benton Counties, Washington, a distance of about 100 miles. The estimated cost is $3,270,000. No definite plans of financing the operation have been worked out.

Advisory Board on Highway Research Reorganized

Thirty-five states have already named representatives and three other states have expressed their intention of appointing a representative to the National Board on Highway Research of the National Research Council. C. M. Upham, the director, recently named to succeed W. K. Hatt, has undertaken to form a council whereon both the designers and the actual road builders may sit in conference. Through the state representation state highway commissions and the advisory board itself will have a medium whereby research problems may be thoroughly studied. The problems will be brought to the attention of the several states and others carrying on research work and the solutions will be made known to the state highway commissions through their representatives or contact men.

The annual meeting of the new National Research Council will be held in Washington, Dec. 4 and 5, when the various committees will report and the program will be presented.

The accompanying diagram indicates the new organization of the Advisory Board on Highway Research.

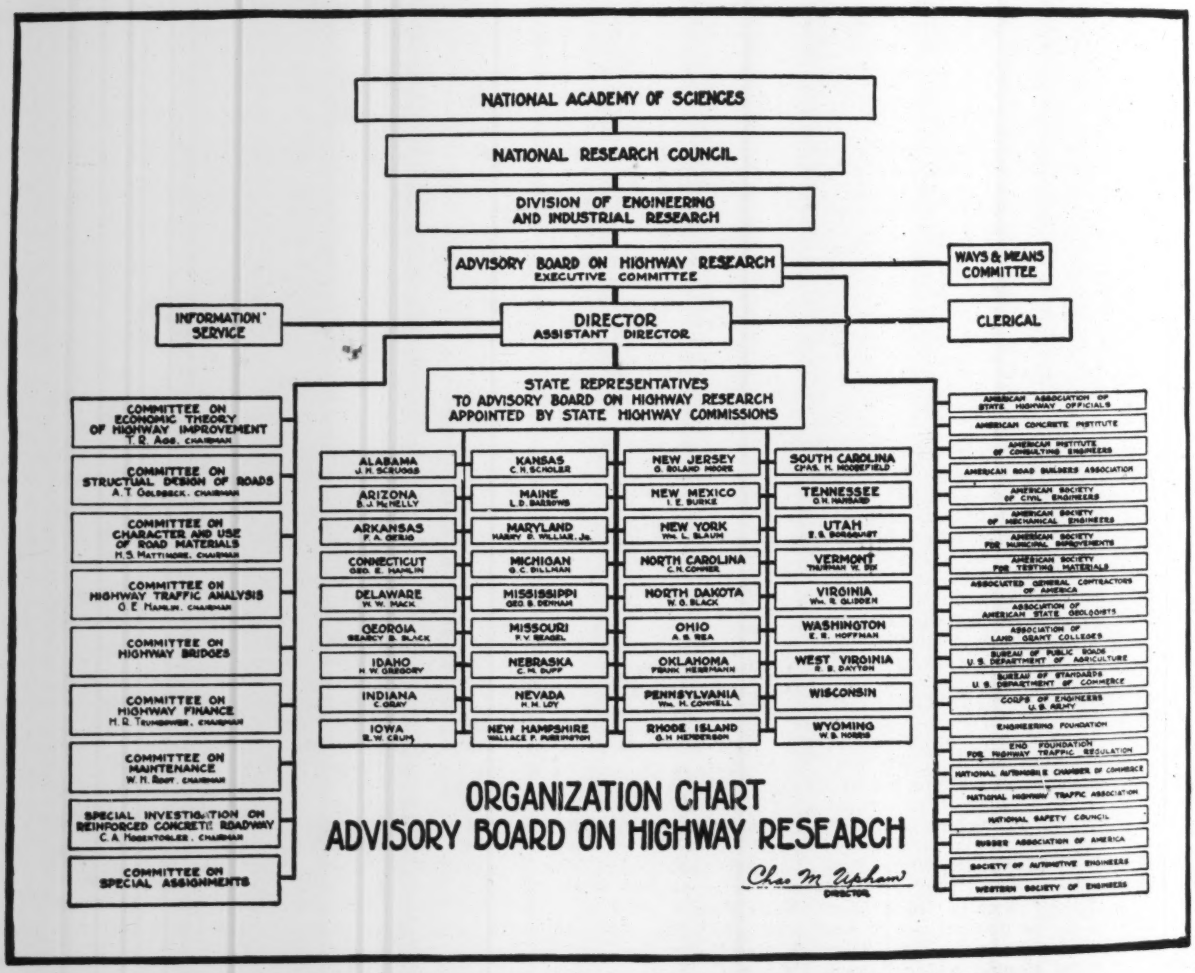


DIAGRAM OF REORGANIZED PERSONNEL OF ADVISORY BOARD ON HIGHWAY RESEARCH

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY OF SANITARY ENGINEERING, New York; Annual Convention, Philadelphia, Pa., Sept. 9-12, 1924.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Meeting, Rochester, N. Y.; Sept. 30 to Oct. 3.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburgh, Fla.; Annual Convention, Boston, Mass., Sept. 29-Oct. 3, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Fall Meeting, Detroit, Oct. 23-25, 1924.

A Detroit Section of the American Welding Society is in process of organization and a meeting will be called in September for formal organization, the membership of the section to include most of the state of Michigan. The temporary chairman of the Detroit section is H. M. Gould, assistant general manager, Department of Street Rys., Detroit, and the temporary secretary is C. L. Finch, Detroit Range Boiler & Steel Barrel Co.; the latter may be addressed at 2475 Twenty-Fourth St., Detroit.

Personal Notes

GEORGE D. BROOKE, heretofore superintendent of transportation, Baltimore & Ohio, Western Lines, with headquarters at Cincinnati, has been appointed assistant to the vice-president in charge of operations of the Chesapeake & Ohio, with headquarters at Richmond, Va. Mr. Brooke is a graduate of Virginia Military Institute. He has been continuously in the service of the Baltimore & Ohio since starting as a rodman in 1902, except for a few months with the United States Railroad Administration in 1918 and 1919.

SR. FERMIN LEON and SR. HECTOR VIGIL, highway engineers from the Republic of Chile, who have been in the United States making a study of highways and construction methods, recently inspected highways in the vicinity of San Francisco and Los Angeles under the guidance of a special representative of R. M. Morton, chief engineer of the California Highway Commission.

LEONARD MARTIN COX, captain, Corps of Civil Engineers, U. S. Navy, retired, has announced his entrance into professional practice in offices occupied jointly with the C. E. Grunsky Co., consulting engineers, at 57 Post St., San Francisco. He will specialize in harbor and port terminal projects, waterways, graving and floating docks, shipyard plants and general maritime engineering. Captain Cox is civil engineering graduate of Rensselaer Polytechnic Institute. He began his service in 1899 as junior lieutenant, assistant to the public works officer on drydock construction at New York; he was public works officer in Guam from 1901 to 1903 and made the first survey of the island. At one time he was assistant public works officer and later public works officer at the navy yards at New York and Norfolk. He served for a time as assistant chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., and in 1912 on the Alaska Railroad Commission. During the War he was with the Emergency Fleet Corporation; since 1919 until his retirement he had been public works officer of the Twelfth Naval District, San Francisco, and of the navy yard at Mare Island, California.

A. C. D. BLANCHARD, heretofore chief field engineer on the Queeston-Chippawa power development of the Hydro-Electric Power Commission of Ontario, has been appointed hydraulic engineer of the New Brunswick Power Commission.

HARVEY W. HARRIS, formerly engineer for the Kelly-Dennis Construction Co., who served on construction of the Turkey Creek sewer, has been appointed chief engineer of the sewer division of Kansas City, Mo.

A. F. CONDON and R. T. REGESTER, under the name of Condon & Regester, civil and structural engineers, have opened an office at 15 East Fayette St., Baltimore, Md., for service in structural designing and detailing for buildings, foundations, bridges, industrial plants, and surveys for housing and community developments.

C. MILES BURPEE has resigned as instructor of drawing and surveying at Marquette University, Milwaukee, Wis., to enter the department of bridges and buildings of the Delaware & Hudson Ry.

HOMER E. ANDERSON, formerly vice-president of the McKelvey Construction Co., and in charge of its Detroit office, announces that he has left the McKelvey company and has opened engineering offices at 1613 First National Bank Building, Detroit, under the name, Homer E. Anderson Co., construction engineers.

E. D. ROBERTS, of Portland, Ore., is to be an assistant professor of civil engineering at Marquette University, Milwaukee, Wis. Mr. Roberts is at present chief engineer for the Sun Portland Cement Co. at Lime, Ore. He is a graduate of Oregon Agricultural College.

COL. HENRY LEE BOWLBY, senior highway engineer and chief of the war material division of the U. S. Bureau of Public Roads, has been appointed chief engineer of the Long Island State Park Commission, and will have charge of an extensive plan for developing new parkways on Long Island to relieve traffic congestion on existing highways and to give access to parks which the commission is acquiring and improving. Colonel Bowlby was chief engineer of the Washington State Highway Commission in 1909; later as state highway engineer of Oregon he constructed portions of the Columbia River highway. He was educated at West Point and the University of Nebraska. During the War he organized and took to France the 43rd Engineers, and after the war directed the distribution of road machinery and other materials from surplus was supplies to the state high departments.

H. E. WARRINGTON and C. H. KROMER have opened an office in the Underwood Building, San Francisco, Calif., under the firm name of Warrington & Kromer, for practice in civil and structural engineering, including railroad and highway bridges and the structural work of buildings, wharves, dams and water-works and sewage-disposal plants. Mr. Warrington was bridge engineer for Los Angeles County eight years and for the California Highway Commission four years. For twelve years Mr. Kromer has been with the state of California, as assistant and as structural engineer in the department of engineering and as chief structural engineer in the division of agriculture in the department of public works.

Obituary

FRANK B. CARVELL, chairman of the Board of Railway Commissioners of Canada, died suddenly at his home in Woodstock, N. B., on Aug. 9. Mr. Carvell was born at Bloomfield, N. B., in 1862, graduated from Harvard College and practiced law until his entry into public life. Beginning in 1904 he served four terms in the House of Commons, two years as Commissioner of Public Works, and in 1919 became chairman of the Board of Railway Commissioners.

JOHN S. EASTWOOD, of Oakland, Calif., patentee of the thin multiple-arch dam, was drowned Aug. 10 while bathing in the Kings River near Fresno. He was 67 years old. Mr. Eastwood was born in Jordan, Minn. He attended the University of Minnesota during the years 1878 and 1880, and after a year spent in railroad work in the Northwest began private practice in Fresno, Calif., in 1883. From 1885 to 1886 he was city engineer of Fresno. He was chief engineer of the Fresno Canal & Irrigation Co. for two years, and for seven years, from 1902 to 1909, was with the Pacific Light & Power Corporation of California, which was later absorbed by the Southern California Edison Co. His work in this connection dealt principally with locations of water power projects, and he made the original locations for the Big Creek plant. In 1913 he returned to private practice with headquarters about San Francisco Bay, and since that date had spent most of his time on the design and construction of multiple-arch dams.

From the Manufacturer's Point of View

A Point of Contact
Between Maker and User of
Construction Equipment and Materials

Increased Space for Railway Appliances Exhibit

The National Railway Appliances Association, Chicago, announces that it has secured increased space for next year's exhibit to be held in Chicago in March, 1925. The association has secured a lease on the new addition to the Coliseum, which will measure 105 x 172 ft. In past years the association and its exhibitors have been hampered because of inability to secure sufficient space. This condition will be corrected by the increased exhibit facilities which will be available for the next show.

Great Lakes Ore Dock Has Nine Mechanical Unloaders

With the recent installation of two mechanical ore unloaders, making a total of nine, the dock at Conneaut Harbor, Ohio, of the Pittsburgh & Conneaut Dock Co., is claimed to be the largest and most completely equipped of its kind in the world. The new machines, which have bucket capacities of 17 tons, supplement the work of the unloaders previously installed, the first of which had 10-ton buckets and were placed in operation in 1910, being at that time the first of their kind.

The unloaders, designed and manufactured by the Wellman-Seaver-Morgan Co., Cleveland, consist of a main framework mounted on trucks which travel along a rail runway. The main framework extends back to the rear runway over a temporary storage pile where ore can be discharged if desired, or else loaded into ore-carrying railway cars. The ore is handled by a stiff bucket leg carried by a balanced walking beam. The buckets are formed from a single piece of plate and provided with manganese steel cutting lips.

The ore unloaders are usually electrically operated on 220-volt direct current. Eight motors are required for each machine, ranging in horsepower from 25, for the operation of bucket rotating, to 275 for the beam hoist.

E. M. Herr Will Head Industrial Mission to Mexico

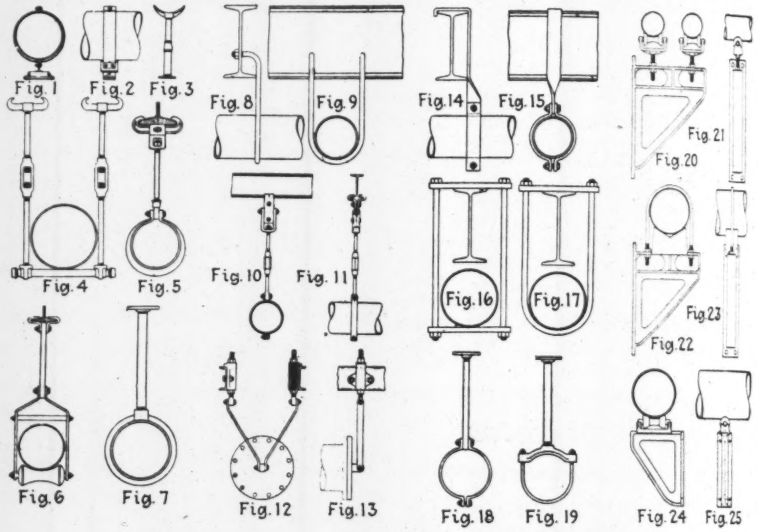
E. M. Herr, president of the Westinghouse Electric & Manufacturing Co., has accepted the chairmanship of the committee which is organizing the American Industrial Mission to Mexico for 1924, for the American Manufacturers' Export Association. Word has been received from Mexico City that Mayor Raya and high officials of the Mexican government intend to meet the American Industrial Mission at the border, at Laredo, probably on Sept. 11. From then on the members of the mission are to be the official guests of the government and the City of Mexico.

With his country now settled down to a long run of industrial prosperity Mayor Raya expressed the belief that American manufacturers will occupy a preferred status with Mexican purchasers and that a large amount of business, profitable for both nations, will result from the visit of the American Industrial Mission.

Both the American and Mexican governments have so strongly approved the visit that it really is taking on a semi-official nature. Representatives have already been named by a number of leading American manufacturers to make the trip to Mexico with the Industrial Mission.

Details of Typical Supports Shown for Power Plant Piping

Supports for piping in power plants vary with the individual plant layouts, but their construction is fairly well standardized. They may be divided roughly into three classes: Hangers, standards, and brackets. For the benefit of the industrial and the power plant engineer, the National Tube Co., Pittsburgh, has assembled a number of typical industrial piping support details which are reproduced in the accompanying drawing. Hangers are used for supporting pipe from ceilings and overhead structural members (Figs. 4-19); standards for supporting pipe on and from engine and boiler-room floors (Figs. 1-3); and brackets for supporting pipe on and from walls and vertical structural members (Figs. 20-25).



TYPICAL SUPPORTS FOR POWER PLANT PIPING

MECHANICAL UNLOADERS AT WORLD'S LARGEST ORE DOCK, CONNEAUT HARBOR, OHIO

Business Notes

C. R. CHADBOURNE, formerly assistant division engineer, Mastic Division, Barber Asphalt Co., Philadelphia, has been made district manager of the Chicago territory of the Republic Creosoting Co., with enlarged offices removed to the Straus Building.

BRANDIS & SONS, Brooklyn, N. Y., manufacturers of surveying instruments, have re-incorporated as Brandis & Sons, Inc., New York. The officers of the new corporation are: President, William F. Brandis; Vice-President, Henry A. Brandis; secretary, Gertrude Coe; treasurer, Charles H. Colvin. There is no change in the factory personnel, William Brandis continuing to directly supervise all manufacturing, graduating and adjusting.

HOWARD BIRD, formerly general manager of the Canadian Pneumatic Tool Co., Ltd., a subsidiary of the Chicago Pneumatic Tool Co., with headquarters in Montreal, has been made managing director of the Consolidated Pneumatic Tool Co., another subsidiary with headquarters in London, from which office he will also carry on the work of director of European sales of the Chicago Pneumatic Tool Co., New York. He succeeds the late H. D. Megary. D. M. WESTBROOK, until recently the district sales manager, Minneapolis branch, will succeed Mr. Bird as general manager of the Canadian Pneumatic Tool Co., with headquarters at Montreal.

GIBB INSTRUMENT Co., Bay City, Mich., manufacturers of electric, arc, spot, seam and automatic welding machines, has placed its Chicago office in charge of W. F. Hebard & Co., 551 W. Van Buren St. Thomas Barnes, an officer of the Hebard Co., will direct the welding department, with Charles Watson of the Gibbs company as his assistant. Mr. Hurd, the retiring representative of the Chicago district, will represent the company in New England.

CHICAGO PNEUMATIC TOOL Co., New York, builder of air compressors, and the INDIANA PUMP Co., Indianapolis, manufacturer of air-lift equipment, have recently made an agreement whereby each will use jointly and exclusively the products of the other on all air-lift installations. Technical consultation relative to the combined unit will be available at any one of the branches of either company.

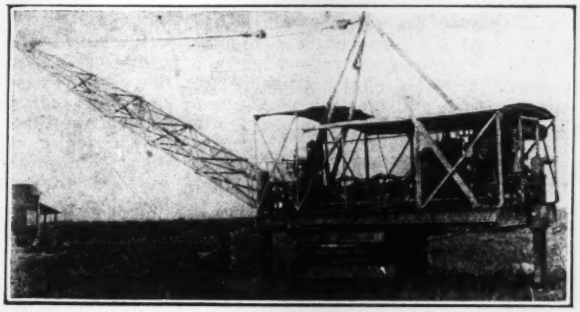
CHARLES T. TOPPING MACHINERY Co., manufacturer of a lightweight traction trench excavator, formerly located in Pittsburgh, Pa., has moved its headquarters to Dayton, Ohio.

Equipment and Materials

Walking Dragline Machine

A sliding platform and a set of spuds are the essential parts for travel of a new walking device for dragline excavators, designed by J. W. Page, of the Page Engineering Co., Chicago, and adaptable to machines of all sizes. The usual lower platform is of octagonal shape and rests directly on the ground, giving a firm bearing surface for the operation of the machine. The lower half of the rail circle is riveted to this platform, while the upper half is riveted to the bottom of a sliding platform whose center beams ride against rollers in the upper platform. When the machine is walking, the lower and sliding platforms form one unit; when it is excavating, the upper and sliding platforms form a unit.

The excavator is moved in any desired direction by four distinct but almost

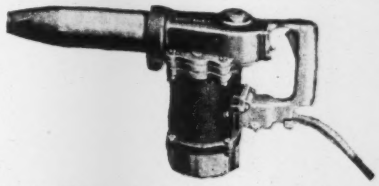


simultaneous operations controlled from the operators' stand and all accomplished in less than half a minute. Three spuds are placed upon the upper platform, one in the center of the machine at the rear and one at each corner in front. Each spud carries a pad or base giving large bearing area. By means of the swinging frictions the spuds are pushed down, thus elevating the whole machine. As soon as the lower platform is clear of the ground it starts to slide back to the extreme end of the upper platform; when it has reached the proper position, the spuds are reversed and the machine is lowered to the ground, the upper platform then sliding back to its working position, where it is ready for another step or for immediate operation. A lift of 3 ft. can be had, if necessary, in moving over very uneven ground or in getting out of a hole. As the spuds are carried on the upper platform and swing with it, a step can be taken in any direction; forward, backward or to either side. An automatic locking device keeps the upper platform from sliding when in its working position.

Flexibility and convenience were kept in mind in the design of this walking dragline machine. Thus the 1½-yd. model, with 55-ft. boom, can be shipped on a single flat car. To keep within railroad clearance limits, the A-frame is hinged just above the cab roof, so that it can be lowered for shipment. For shipping long distances and through tunnels, the lower platform can be removed and divided into two sections. Power is furnished by a Diesel four-cycle oil engine of the solid injection type, using any low-grade of fuel oil that will flow freely. The engine is geared directly to the drum set by a pinion on the end of the driving shaft. Starting when cold is accomplished by means of compressed air.

Electric Hand Hammer Drill

For drilling concrete and soft stone, as well as for light chipping of metals, the Chicago Pneumatic Tool Co., New York, has placed on the market the



Little Giant electric hammer drill with Universal motor operating interchangeably on direct or alternating current. The blow delivered on the drill steel is the result of energy stored up by a rapidly moving piston mechanically free from the impelling force. The connection between the piston and the driving mechanism is by means of air, forming a cushion at the end of the up stroke and expanding to deliver a blow.

Operation is through a trigger switch in the handle controlling the electric current. The rotating elements of the drill are carried on ball bearings. Designed for holes up to 1 in. in diameter, the drill strikes 1,450 blows per minute, weighs 21 lb., and has an overall length of 17½ in. Motor windings for 115 or 230 volts are supplied. Rotation of the drill steel is by means of a hand wrench.

Power Operated Earth Drill for Post Holes

For digging holes in earth for telegraph poles, fence posts, blasting or foundations, the Buda Co., Harvey, Ill., has developed the Buda-Hubron earth drill operated by a two-cylinder gasoline engine and made portable by mounting on a two-wheel truck. The

outfit weighs 1,400 lb. Under ordinary conditions, the manufacturer claims, an 18 in. hole can be sunk 6 ft. deep in earth in 5 min. The device has been used for digging holes for guard rail posts on state and county highway work.

The drills, in sizes up to 20 in. diameter, are in the form of a single cast steel helix with removable manganese and carbon steel cutters. As earth is dug up by the drill cutter it is forced upward through a check valve and slips on the polished top of the helix so that it does not turn in the hole with the drill. When 2 ft. of earth has collected on the top of the drill, the drive clutch is disengaged, the drill raised to the surface by engaging a lifting clutch, and the earth discharged.

Automatic Sump Pump

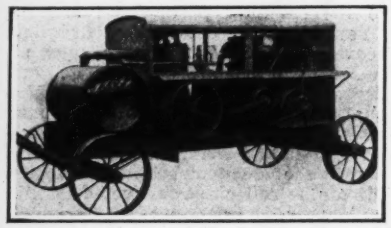
For draining cellars, foundations, pits and pipe trenches, the Goulds Manufacturing Co., Seneca Falls, N. Y., announces an electrically operated sump pump, started and stopped automatically by a float which actuates the motor switch. The unit is built in only one standardized size with ½-hp. vertical type motor, 1-in. discharge pipe, and a total weight of 210 lb. The pump element has a cast-iron volute casing and open type bronze impeller, and is suspended by a 2½-in. steel pipe. The pit cover is 20 in. in diameter and fits into the bell of a standard 18-in. tile pipe. The pump shaft is carried by ball thrust bearings. Operating at 750 r.p.m., the unit has capacities ranging from 10 gal. per minute against a head of 24 ft. to 35 gal. per minute against a head of 13 ft.

New Portable Air Compressor Has 170-Cu.Ft. Capacity

The range of capacities of its portable air compressors has been extended by the Novo Engine Co., Lansing, Mich., which has just announced a new unit with a displacement of 170 cu.ft. of free air per minute, capable of operating the following pneumatic tools: Two hand hammer drills; four pavement breakers (intermittently); or four clay diggers. The company's two other sizes of compressor previously on the market have displacements of 45 and 90 cu.ft., respectively.

The new 170-ft. unit is self-contained, mounted on steel or rubber-tired wheels, and inclosed in a steel housing. The power equipment consists of a four-cylinder, 25-40-hp. gasoline engine with radiator and fan. The compressor is a 7x6-in. duplex vertical, single-acting machine, driven by a short endless belt 8 in. wide. Independent cooling systems are provided for both engine and compressor. The machine is designed to deliver air at 100 lb. per square inch pressure.

The outfit has the following overall dimensions: Length, 137 in.; width, 73 in., and height, 70 in. The shipping weight is 5,860 lb. The air receiver,

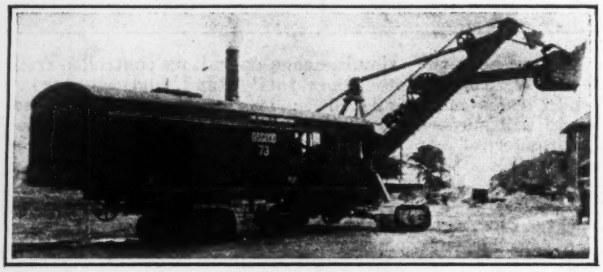


mounted on the front end of the frame, is a cylinder 24 in. in diameter, 42 in. long with a capacity of 11 cu.ft. The fuel consumption, the manufacturer states, is 3 gal. of gasoline per hour at full load.

Continuous Tread Mountings for Railroad Type Shovels

The Osgood Co., Marion, Ohio, has recently added continuous tread equipment to its line of mountings for standard shovels, supplementing the railroad truck and traction mountings. The continuous tread mountings are made for shovels of dipper capacities ranging from 1½ to 6 cu.yd. and can be put on in the field to replace other mountings.

The advantages claimed for the continuous tread mounting are that track



and accessories are eliminated; the pit crew is dispensed with or greatly reduced; the shovel can be kept in the most effective digging position, back away from blasting and travel and work in water. With the new mounting the time required for changing locations is greatly reduced. The general arrangement of the mounting is indicated in the accompanying photograph.

The front tread belt units are mounted on journals at the outer ends of the jack arms and can rock to accommodate themselves to uneven ground surfaces. The rear truck furnishes a third point of support for the shovel and has a universal action so as to rest firmly on uneven surfaces. Steering is accomplished by slewing the rear truck. Propelling drive is either through the front units alone or through both front and rear trucks. From the ends of the forward shaft in the sub-frame the power is continued out to each front unit by a universal-jointed propeller shaft. Since the continuous tread units are free to rock each of the shafts is fitted with full universal joints and a telescoping slip joint.

Publications from the Construction Industry

Manganese Steel Castings—AMERICAN MANGANESE STEEL CO., Chicago Heights, Ill., has just published a general catalog describing the manufacture of manganese steel castings and their application to a wide variety of uses in industry. In addition to the general catalog, the company has issued specialized pamphlets applying to different fields, including quarries, construction, mines, and brick and clay industries. The extreme toughness of manganese steel castings makes them economical under conditions where hard usage and long wear must be combined. The general catalog deals with a number of such typical uses as steam shovel dippers, clamshell and orange-peel buckets, conveyors, crushers, ditching machines, dredge pumps, screens, and gears and pinions.

Wiring and Lighting Data—WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa., has issued the third edition of "Handy Wiring Tables and Illuminating Data." This 52-p. booklet contains detailed directions for accurately laying out the wiring for an industrial or commercial lighting system, and is intended for the guidance of architects, builders, electricians and electrical dealers. A feature of the publication is a table of the present standards of desirable illumination for various classes of service, giving the range of foot-candles most desirable for illumination in practically every branch of industry where artificial light is used. A complete table of foot-candle values for lamps of different wattage in areas of different size is included. Various types of commercial luminaires manufactured by the Westinghouse company are described and pictured.

Portland Cement—MARQUETTE CEMENT MFG. CO., Chicago, Ill., is distributing a 43-p. illustrated pamphlet entitled "100 Years of Portland Cement" commemorating the centennial of portland cement and the twenty-fifth year of the Marquette company. Bertrand C. Wheeler is the author of this historical sketch.

Back-Dump Buckets — MANSFIELD ENGINEERING CO., Indianapolis, describes and illustrates the Pioneer back-dump bucket in a 31-p. illustrated pamphlet just issued. The bucket is designed for slack line cableway operation, especially in digging sand and gravel. The back dump feature follows the general design of a steam shovel dipper.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for in Construction News, pp. 101 to 113, are the following:

Group of Public Buildings, San Francisco, Calif., $1,500,000.

Apartment, New York, N. Y., $1,500,000.

Club, Los Angeles, Calif., $1,000,000.

Hospital, Auburn, N. Y., $500,000.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 101 to 113, are the following:

Bank and office, Dallas, Tex., to Inge Constr. Co., $1,500,000.

Trunk sewer, Jersey City, N. J., to Hannen Constr. Co., Perth Amboy, $1,147,110.

Hotel, Portland, Me., Congress Sq. Hotel Co. by day labor, $1,000,000.

Office, New Orleans, La., to G. M. Gwin Constr. Co., $1,000,000.

Road Building Records Broken in Illinois

Three world's records for road building established in Illinois during 1923 were shattered by contractors working on the Illinois State Highway system during the week ended August 2, the Illinois Division of Highways has announced.

During the week a total of 60.79 mi. a pavement were constructed, exceeding by 3.09 mi. the previous record. A crew working on Route 2 between Decatur and Pana laid 2,671 ft. of standard 18-ft. concrete pavement in one day with one mixer, eclipsing the previous high mark of 2,017 ft. for a day's run from a single mixer. The same crew set another record when it completed 10,405 ft. of pavement in one week. The previous best output of one mixer for a single week was 8,463 ft. of standard 18-ft. concrete pavement.

Eleven thousand men, 3,000 teams and 116 large mixers were at work on Illinois state roads during the week ended August 2.

July Bond Sales Heaviest for That Month Since 1907

The public bond sales during July, according to the *Commercial and Financial Chronicle*, aggregated $109,467,071 as compared with $271,685,940 for the month of June and $67,776,833 for July 1923. The total for July 1924 is the greatest for this month since the year 1907.

The largest block to be placed in July was for $9,010,000 at 6 per cent by the Merced Irrigation District, Calif. Other large issues were: Los Angeles County Flood Control District, $5,000,000; Philadelphia School District, $5,000,000; Chicago Sanitary District, $5,000,000; Springfield, Mass., $4,134,000; Denver, Colo., $4,000,000.

In the table following; one sale was made at par, four below and forty-six above par. The rates ranged from 4 to 6 per cent.

REPRESENTATIVE PUBLIC BOND SALES, JULY, 1924

State	Purpose	Amount	Rate Per Cent	Sold For	Basis	Dated	Maturity	Purchased By
California	Highways	$3,000,000	4½	106.05	4.19	July 3	1963—65	First Natl. Bank of N. Y. C., and others
Delaware	Highways	500,000	4	99.089	4.05	Jan. 1	1964	Kean, Taylor & Co., N. Y. C.
Michigan	Highway	3,000,000	4–4¼	100.001	4.115	Aug. 1	1944	Equitable Trust Co. of N. Y. C. and others
County								
Ashtabula, O.	Road impvt.	33,000	5	101.81	4.625	Apr. 1	1925—33	Detroit Trust Co., Detroit
Buncombe, O.	Road and bridge	300,000	5	100.31	4.72	July 1	1929—58	W. L. Slayton & Co., and others
Brown, Wis.	Highway impvt.	330,000	4½			July 1	1931—43	The Second Ward Securities Co.
Benton, Ind.	Road	23,400	5	103.23	4.27	July 1	1925—34	J. F. Wild & Co.
Cooper, Mo.	Road	45,000	5	101.72	4.91	Aug. 15	1926—40	Harris Trust & Savings Bank
Clinton, O.	Road	166,700	5½	104.51	4.78	June 15	1925—34	Title Guarantee & Trust Co.
Dodge, Wis.		337,000	5	105.12	4.43	Apr. 1	1924—43	First Wisconsin Co.
Franklin, O.	Road	59,000	5	102.22	4.475	July 15	1925—33	The Detroit Trust Co.
Greene, Ind.	Road	22,000	5	103.20	4.84	July 15	1925—34	First Nat. Bk. of Linton
Guernsey, O.	Road	109,400	5½	104.67	4.66	July 5	1926—35	Title Guarantee & Trust Co.
Hancock, O.	Road	15,000	5	101.95	4.62	July 7	1926—34	Provident Savings Bank & Trust Co.
Hawkins, Tenn.	Road	75,000	5½	101.42	4.85	Sept. 1	1930—44	Caldwell & Co.
Howard, Md.	Road	200,000	4½	103.63	4.23	July 1	1927—54	Alex Brown & Sons
Iredell, N. C.	Road and bridge	200,000	5	102.06	4.80	July 15	1924—49	C. W. McNear & Co.
Jefferson, O.	Road	33,400	6	106.17	5.65	June 1	1925—33	Provident Savings Bank & Trust Co.
Laclede, Mo.	Courthouse	80,000	5	103.56	4.61	June 1	1925—44	Liberty-Central Trust Co.
Lyon, Minn.	Road	90,000	4½	101.002	4.45	June 1		Northwestern Trust Co.
Marion, Ind.	Road	109,000	4½	100.52	4.62	Jan. 1	1925—34	Fletcher-American Co.
Marion, Fla.	Road	1,500,000	5	96.83	5.16	July 14	Serially	Seasongood & Mayer and others
Putnam, Tenn.	Highway	61,000	5	102.93	4.77	Aug. 1	1944	Harris Trust & Savings Bank
Ross, O.	Road	128,500	5½	104.18	4.55	Aug. 1	1925—33	Stevenson, Perry, Stacy & Co.
Ramsey, Minn.	Hospital	266,000	4½	100.05	4.36	July 14	1925—44	Wells-Dickey Co.
Township								
Danbury, O.	Road	24,000	5½	101.26	5.19	July 15	1925—32	Ryan, Bowman & Co.
Linden, N. J.	Improvement	201,000	5	100.25	4.98	Aug. 1	1925—74	National Bank of Elizabeth
Summit, Pa.	Road	12,000	5½	102.69	4.84	July 1	1926—31	M. M. Freeman & Co.
Municipalities								
Albany, N. Y.	Public impvt.	1,310,000	4½	101.037	4.01	June 1	1925—44	Guaranty Co. of N. Y. and others
Anaheim, Calif.	Water works	110,000	5	103.10	4.74	July 15	1925—60	Anglo-London Paris Co.
Battle Creek, Mich.	Paving	70,000	4½	100.01	4.61	Mar. 1	1925—38	Stranahan, Harris & Oatis
Blanchester, O.	Water supply	49,900	5½	105.08	4.96	Mar. 1	1925—49	A. E. Aub & Co.
Bridgeport, Conn.	School	450,000	4½	102.66		July 15	1925—54	R. M. Grant & Co.
Buffalo, N. Y.	Public works	144,500	4	100	4	July 1	1925—44	
Burlington, N. J.	Improvement	104,000 22,000	4½	100.78	4.60	June 1	1930	N. J. Fidelity Plate Glass Co.
Camden, N. J.	Public impvt.	893,100	4½	101.13	4.17	Aug. 1	1926—64	Phelps, Fenn & Co.
Chicago San. Dist., Ill.	Sanitary	5,000,000	4	98.226	4.22	July 1	1925—44	Ill. Merchants Trust Co. and others
Columbus, Ga.	Improvement	900,000	5	104.13	4.59	Aug. 1	1925—54	Merchants & Mechanics Bk.
Denver, Colo.	Water	4,000,000	4½	103.02	4.31	Aug. 1	1943—62	Newton & Co.
Detroit, Mich.		3,000,000	4½	100.037				First National Co.
Easton, Pa.		250,000	4½	101.51	4.14	July 1	1954	First National Bank
Greensburgh, Pa.	Paving	200,000	4½	104.45	4.15	July 1	1928—53	Union Trust Co.
Hamburg, N. Y.		400,000	4½	102.18	4.33	Aug. 1	1925—64	Fed. Trust Co.
Hibbing, Minn.	Building	400,000	5	100.76	4.85	July 8	1926—33	Minn. Loan & Trust Co.
Kansas City, Mo.	School	2,000,000	4½	102.95	4.32	Jan. 1	1953	First Nat. Bk. of N. Y. C. and others
Litchfield, Conn.	School	125,000	4	101.99	3.903	Aug. 1	1929—53	R. F. Griggs & Co.
Malden, Mass.	Public works	454,000	4	100.79	3.92	Aug. 1	1925—44	Merrill, Oldham & Co.
Miami, Fla.	Improvement	950,000	4½	98.89	4.84	July 1	1935—54	J. H. Hilsman & Co.
Minneapolis, Minn.	Building	500,000	4½	100.451	4.19	July 1	1925—44	Thayer, Beebe & Co.
Norfolk, Va.	Improvement	2,897,000	4½	100.097	4.68	July 1	1928—47	Detroit Co., Inc.
Philadelphia, Pa.	School	5,000,000	4½	101.53	4.39	Aug. 1	1935—54	Reilly, Brock & Co.
St. Paul, Minn.	Improvement	2,135,000	4½	101.18	4.15	July 1	1925—54	Remick, Hodges & Co., and others

Unit Prices Bid on Dike Job

An idea of unit costs of various items in dike construction may be gained from the accompanying tabulation.

This is an abstract of proposals for the building of a dike in the Delaware River near Alloway Creek, N. J., received and opened Aug. 8, at the U. S. Engineers' Office, 1505 Race St., Philadelphia, Pa.

These items are all in place on the job and represent bids received from seven large construction organizations.

It is interesting to note that the low bidder ($206,615) places the time of completion at 180 days, while the highest bidder ($248,023) allows a maximum of 150 days. The shortest time limit placed is 145 days at $245,072.

ABSTRACT OF PROPOSALS FOR CONSTRUCTION OF DIKE IN DELAWARE RIVER

Items (All in place in dike)		Triest Contracting Corporation, New York, N. Y.	Louis J. Sieling, Red Bank, New Jersey	Raymond Concrete Pile Company, New York, N. Y.	Arundel Corporation, Pier 2, Pratt St., Baltimore, Md.	Frederick Snare Corporation, 1524 Chestnut St., Philadelphia, Pa.	General Ship Repair Company, 113 Walnut Street, Philadelphia, Pa.	McLean Contracting Corporation, Fidelity Building, Baltimore, Md.
Round piles, 113,000 lin.ft.	Unit	$0.63	$0.72	$0.396	$0.40	$0.30	$0.47	$0.50
	Total	71,190	81,360	44,748	45,200	33,900	53,110	56,500
Wales and sheathing, 238,500 ft. B.M.	Unit	152.00	80.00	150.00	96.00	92.00	90.00	105.00
	Total	36,252	19,080	35,775	22,896	21,942	21,465	25,042
Galvanized tie rods, nuts, washers, 29,000 lb.	Unit	0.15	0.10	0.15	0.11	0.10	0.07	0.10
	Total	4,350	2,900	4,350	3,190	2,900	2,030	2,900
Black steel bolts, nuts, washers, spikes, 27,000 lb.	Unit	0.14	0.07	0.15	0.10	0.10	0.06	0.10
	Total	3,780	1,890	4,050	2,700	2,700	1,620	2,700
Rip-rap stone, 37,000 tons	Unit	3.50	3.00	4.30	3.86	4.98	3.47	3.80
	Total	129,500	111,000	159,100	142,820	184,260	128,390	140,600
Total of bid		$245,072	$216,230	$248,023	$216,806	$245,702	$206,615	$227,742
Time of completion—days		145	210	150	160	180	180	180

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of August 7, the next, on September 4.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.34	$3.80	$4.20	$3.10	$3.35	$4.00	$3.40	$3.35	$4.20
Structural rivets, 100 lb.	3.75	+4.35	4.90	3.50	3.75	4.65	5.00	3.75	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.24	3.30	3.38	3.00	3.25	3.87½	3.35	3.25	2.70
Steel pipe, black, 2½ to 6 in. lap, discount	44%	54.2%	43%	53%	55.05%	36%	36.80@49.10%	45%	47.43
Cast-iron pipe, 6 in. and over, ton	60.60@61.60	—52.00	60.00	56.20@57.20	58.50	68.00	59.00	65.00	65.00
Concreting Material:									
Cement without bags, bbl.	2.50@2.60	2.35	2.05	2.20	2.42	2.84	2.61	2.90	1.80
Gravel, ¾ in., cu.yd.	1.75	+1.90	2.38	2.75	1.85	1.90	2.15	1.50	1.25
Sand, cu.yd.	1.00	1.40	2.00	2.75	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.00	2.83	2.75	1.75	3.50	2.15	3.00	2.25
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	57.00	35.00	57.20	55.00	37.75	34.75	31.00	23.00	60.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.60	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.45	1.85	1.50	1.40	2.70	2.15	2.80	10.50
Common brick, delivered, 1,000	—18.15	11.00	14.10	12.00	13.00	12.00	15.50	15.00	17.50
Hollow building tile, 4x12x12, per block	Not used	.10	.11	.089	.08	.085	.....	.11	.12
Hollow partition tile 4x12x12, per block	.1162	.10	.11	.089	.....	.085	.108	.11	.10
Linseed oil, raw, 5 bbl. lots, gal.	1.05	+1.13	1.20	+1.05	1.14	1.24	1.01	1.13	1.01
Common Labor:									
Common labor, union, hour	.75	.30	.....	.87½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	....	.25	.30@.50	.82½	.50@.55	.35@.50	.50	.62½	.30@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93¾c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; lump finishing lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand stone, gravel and lump lime per ton. Stone, lime and tile are delivered; sand, gravel and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.97). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3-in., $47.43; 6-in. $119.

Conditions Affecting the Market

There has been considerable improvement in the lumber market during the past week. Prices are firm at present levels in most of the important centers.

Yellow pine demand is more active, with greater stability of prices. There is continued improvement in the fir timber market especially in demand from farming states, where wheat and corn prices have been higher recently.

Slight advances are reported from the South in such items as structural rivets and gravel. Declines, however, are noted in c.-i. pipe in that section of the country.

Fluctuations in linseed oil prices continue, with advances slightly in excess of declines.

Common brick quotations are $15 per M, wholesale, alongside dock, New York, against $20, which price prevailed between April and July of the current year. Brick was $21 per M., a year ago in this city.

Improvement is reported in the steel industry, particularly in bookings of structurals. Optimism is also reflected in reports of the cement, non-ferrous metals, leather and textile industries.